

AD-A082 672

BERGER ASSOCIATES INC HARRISBURG PA
NATIONAL DAM INSPECTION PROGRAM. SCS DAM PA-419 (NDI NUMBER PA---ETC(U)
MAR 80 / DACW31-80-C-0019

F/G 13/13

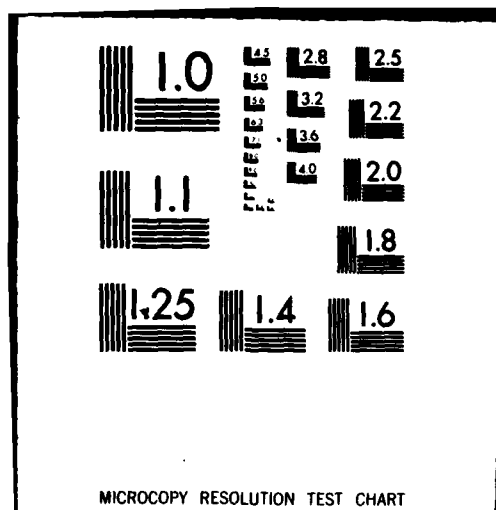
UNCLASSIFIED

NL

1-1
MAY 80



END
DATE
FILMED
5-80
DTIC



AL A 082672

DISCLAIMER NOTICE

**THIS DOCUMENT IS BEST QUALITY
PRACTICABLE. THE COPY FURNISHED
TO DTIC CONTAINED A SIGNIFICANT
NUMBER OF PAGES WHICH DO NOT
REPRODUCE LEGIBLY.**

1

PREFACE

This report has been prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

ACC	
RECEIVED	
DATE	
BY	
FILE	
DISC	
A23	

ORIGINAL COPY AND COPIES PLATED: ALL DDC
REPRODUCTION BY ANY MEANS IN BLACK AND WHITE

DISTRIBUTION STATEMENT A

Approved for public release
Distribution Unlimited

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITIONS
AND RECOMMENDATIONS

Name of Dam: SCS DAM PA-419
State & State No.: PENNSYLVANIA, 64-170
County: WAYNE
Stream: TRIBUTARY TO INDIAN ORCHARD BROOK
Date of Inspection: November 7, 1979

Based on the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in good condition.

In accordance with the Corps of Engineers' evaluation guidelines, the size classification of this dam is small and the hazard classification is high. For this dam the recommended Spillway Design Flood (SDF) is the Probable Maximum Flood (PMF). The spillway capacity is adequate to pass the PMF peak inflow without overtopping the dam, and is considered to be adequate.

The following recommendations are presented for immediate action by the owner:

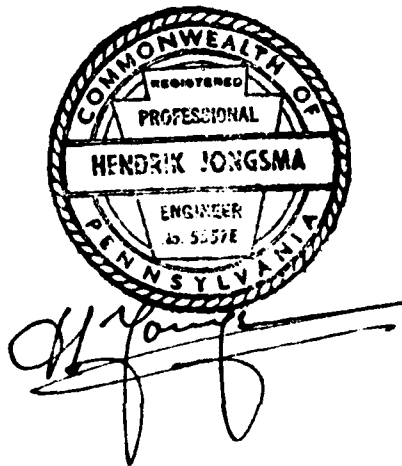
1. That the grazing of cattle on the embankment be discontinued.
2. That weed growth on the slopes be controlled.
3. That a formal surveillance and downstream warning system be developed for implementation during periods of high or prolonged rainfall.

4. That a program be developed for regular maintenance and inspection of the dam and its appurtenant structures.

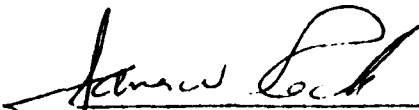
SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

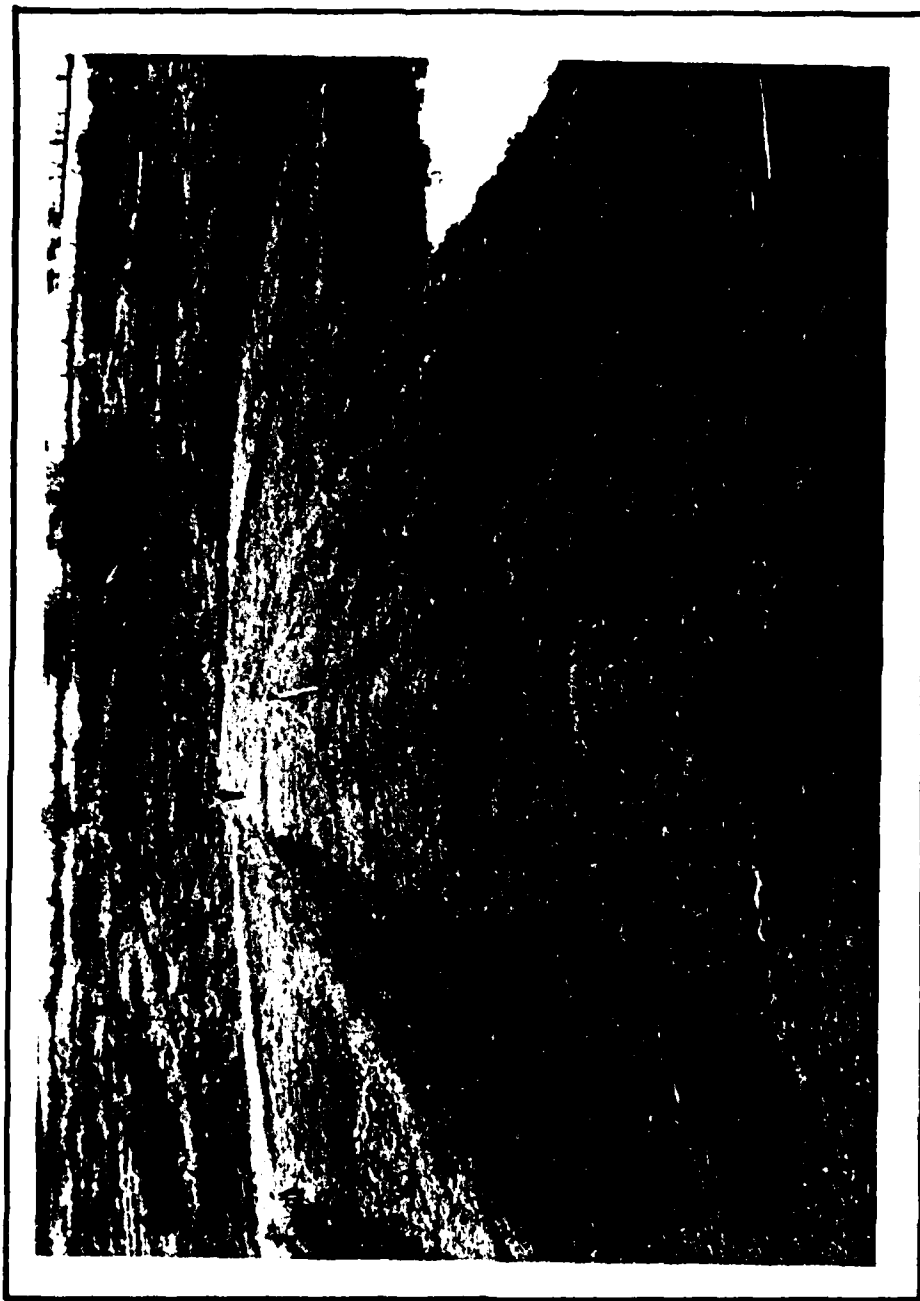
DATE: March 10, 1980



APPROVED BY:


JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

DATE: 25 March 1980



OVERVIEW

SCS DAM PA-419

Photograph No. 1

TABLE OF CONTENTS

	<u>Page</u>
SECTION 1 - <u>PROJECT INFORMATION</u>	
1.1 GENERAL	1
1.2 DESCRIPTION OF PROJECT	1
1.3 PERTINENT DATA	2
SECTION 2 - <u>ENGINEERING DATA</u>	
2.1 DESIGN	5
2.2 CONSTRUCTION	5
2.3 OPERATION	5
2.4 EVALUATION	5
SECTION 3 - <u>VISUAL INSPECTION</u>	
3.1 FINDINGS	7
3.2 EVALUATION	8
SECTION 4 - <u>OPERATIONAL PROCEDURES</u>	
4.1 PROCEDURES	9
4.2 MAINTENANCE OF DAM	9
4.3 MAINTENANCE OF OPERATING FACILITIES	9
4.4 WARNING SYSTEM	9
4.5 EVALUATION	9
SECTION 5 - <u>HYDROLOGY/HYDRAULICS</u>	
5.1 EVALUATION OF FEATURES	10
SECTION 6 - <u>STRUCTURAL STABILITY</u>	
6.1 EVALUATION OF STRUCTURAL STABILITY	12
SECTION 7 - <u>ASSESSMENT AND RECOMMENDATIONS</u>	
7.1 DAM ASSESSMENT	14
7.2 RECOMMENDATIONS	14
 APPENDIX A - CHECK LIST OF VISUAL INSPECTION REPORT	
APPENDIX B - CHECK LIST OF ENGINEERING DATA	
APPENDIX C - PHOTOGRAPHS	
APPENDIX D - HYDROLOGY AND HYDRAULIC CALCULATIONS	
APPENDIX E - PLATES	
APPENDIX F - GEOLOGIC REPORT	

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

SCS DAM PA-419

NDI-ID NO. PA-00086
DER-ID NO. 64-170

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States.

B. Purpose

The purpose of this inspection is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

This flood control dam was designed by the United States Soil Conservation Service (SCS) and is known to its owners as SCS Dam PA-419. The facilities, completed in 1960, consist of a 420-foot long homogeneous earthfill embankment with a maximum height of 29 feet above the streambed. The structure has two spillways. The principal spillway is a drop inlet structure and discharges through a 24-inch diameter pipe. An emergency spillway is located in the right abutment. This spillway consists of a grassed earth channel with a bottom channel width of 41 feet. The emergency spillway crest is 5 feet below the top of the dam.

- B. Location: Berlin Township, Wayne County
U.S.G.S. Quadrangle - White Mills, Pa.
Latitude 41°-34.2', Longitude 75°-11.1'
Appendix E, Plates I & II
- C. Size Classification: Small (Height 29 feet
Storage 139 acre-feet)
- D. Hazard Classification: High (Refer to Section 3.1.E)

E. Ownership (Maintenance): Wayne County Commissioners
Wayne County Court House
Honesdale, PA 18431

F. Purpose: Flood control

G. Design and Construction History

The flood control dam was designed by the U.S.D.A. Soil Conservation Service. An application for a permit to construct the dam was filed by the Wayne County Commissioners and approved by the Pennsylvania Department of Environmental Resources (PennDER) on April 8, 1959. Construction was completed by November, 1960.

H. Normal Operating Procedures

The facilities were constructed to retard storm water runoff. Both spillways are uncontrolled. All inflow is discharged through the principal spillway till the pool level reaches the level of the emergency spillway crest.

1.3 PERTINENT DATA

A. Drainage Area (square miles)

From files:	.52
Computed for this report:	.55
Use:	.55

B. Discharge at Dam Site (cubic feet per second)
See Appendix D for hydraulic calculations

Maximum known flood	67
Principal spillway at pool Elev. 1273.2 (Emergency spillway elevation)	68
Principal spillway at pool level Elev. 1278.1 (Low point of dam)	75
Emergency spillway capacity at pool Elev. 1278.1 (Low point of dam)	1505
Total spillway capacity	1580

C. Elevation (feet above mean sea level)

Top of dam (design)	1279.0
Top of dam (low point as surveyed)	1278.1
Emergency spillway crest (as surveyed)	1273.2
Emergency spillway crest (design)	1274.0
Principal spillway crest	1261.67
Orifice opening invert (normal pool)	1259.0
Pond drain invert	1249.75
Downstream outlet invert	1248.0
Streambed at centerline of dam - estimate	1249.0

D. Reservoir (miles)

Length of normal pool	.1
Length of maximum pool	.2

E. Storage (acre-feet)

Sediment pool (Elev. 1259)	12
Top of dam (Elev. 1278.1)	139

F. Reservoir Surface (acres)

Sediment pool (Elev. 1259)	2.1
Emergency Spillway crest (Elev. 1273.2)	8.9
Top of dam (Elev. 1278.1)	11.3

G. Dam

Refer to Plate III and VI in Appendix E for plan and section.

Type: Homogeneous earthfill.

Length: 420 feet.

Height: 29 feet.

Top Width: Design: 14 feet, Surveyed: 17 feet.

Side Slopes:	Design	Surveyed
Upstream	3H to 1V	2.9H to 1V
Downstream	2H to 1V	2H to 1V

Zoning: Homogeneous. Upstream slope protected with riprap to elevation 1264.0. Seepage and toe drain in downstream section (Plate V, Appendix E).

Cutoff: None.

Grouting: None.

H. Outlet Facilities

One 12" dia. orifice (invert Elev. = 1249.75) with slide gate is located in principal spillway riser. The gate is operated from the top of the drop inlet structure. Discharge from inlet structure is through the principal spillway conduit.

I. Spillways

Principal

Type: Two 6' long x 8" high orifices, uncontrolled.

Location: 6' x 2' drop inlet structure near upstream toe at center of dam.

Invert: 1261.67

Discharge Conduit: 24" dia. pipe through embankment.

Sediment Pool

Type: 12" dia. orifice in drop inlet structure, uncontrolled.

Invert: 1259

Emergency

Type: Uncontrolled, sod-lined, broad crested weir and channel. Upstream slope 2.2%, downstream slope = 3.4%.

Crest Elevation: 1273.2

Width: 41 feet on bottom with side slopes of 2.6 H to 1V on left and 2.4H to 1V on right.

J. Regulating Outlets

See Section 1.3.H above.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The engineering design data for SCS Dam PA-419 are found in two principal documents: a design report and the construction drawings. Both documents were prepared by the S.C.S., the design agency. The design report is a comprehensive documentary report with hydrologic and hydraulic data, soils investigation information, including field and laboratory results, geologic report, structural design calculations and specifications. This report and full size drawings are available in the files of Pennsylvania Department of Environmental Resources (PennDER). Several of the drawings have been reduced and are included in Appendix E of this report. Reference is made to Section 5.1.A. and 6.1.B. of this report for discussion of some of the available design criteria.

2.2 CONSTRUCTION

Construction reports were not available in the PennDER files except that the period of construction was between April 1959 and October 1960.

A copy of the proposed project specifications is included in the design report. As built plans are available in the SCS office, Harrisburg, PA.

2.3 OPERATION

There are no formal records of operation in the files of the owner, PennDER or S.C.S. The purpose of the facility is flood control and other than an annual maintenance inspection program, there are no other operational procedures.

2.4 EVALUATION

A. Availability

Copies of the design report and specifications are available in the files of PennDER. Duplicate information is available in the files of S.C.S. in Harrisburg, PA.

B. Adequacy

The available engineering data is considered sufficiently adequate for making a reasonable assessment of the design of the dam.

C. Operating Records

Operating records are not maintained by the County.

D. Post Construction Changes

There have been no modifications made to this facility since the completion of its construction in 1960.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of SCS Dam PA-419 is good. The dam, completed in 1960, was designed and constructed by the Soil Conservation Service as a flood control structure and is located on privately owned property. The County Commissioners of Wayne County are responsible for the maintenance of the dam and its appurtenant structures. An access easement agreement exists between the owners of the property and the Commissioners. The contributing drainage area is small. The property owner, Mr. Martin, reported a maximum pool elevation one foot below the crest of the emergency spillway.

The visual inspection check list and sketches of the general plan and profile of the dam, as surveyed during the inspection, are presented in Appendix A of this report. Photographs made during the inspection are reproduced in Appendix C.

B. Embankment

The function of this dam is to detain storm water runoff and to release it slowly thus reducing the peak discharge in the downstream area. Storage, therefore, is its prime function. Most of its upstream slope is exposed. The upstream slope is in good condition and is protected with riprap up to an elevation of 5 feet above normal pool level.

The top and the downstream slope of the embankment have been used for grazing of cattle. This has caused considerable damage to the protective vegetative cover of these parts of the embankment. There were no indications of seepage on the downstream slope or at the toe of the embankment. However, the normal pool level is only about 10 feet above the outlet pipe elevation. A wet area was observed downstream of the toe of the embankment (Refer to Plate A-I, Appendix A) to the right of the outlet pipe. This area is above normal pool elevation and the wet condition is attributed to side hill drainage rather than seepage through the embankment.

The horizontal alignment of the dam is straight. The vertical profile of the dam varies more than 2 feet from the right end to the left end (Refer to Plate A-II, Appendix A). Although the surveyed elevation is about one foot below the design elevation, the emergency spillway crest appears also to be about .8 feet below the design elevation.

C. Appurtenant Structures

There are two spillways: the principal spillway and an emergency spillway. The principal spillway consists of a drop inlet type structure with an orifice opening and two sidewall antivortex openings. There is a gated opening at the bottom of the structure for drawdown purposes. The intake structure is accessible by boat only and was not inspected. The water discharges from the structure by means of a 24-inch pipe through the embankment. The outlet of the pipe projects several feet beyond the downstream toe and discharges into a rocklined plunge pool.

The emergency spillway is located in the right abutment and consists of a grassed earth channel. The protective grass cover was in good condition. There is a small natural spur dike on the left upstream side and a low earthfill embankment guide dike on the downstream side. Most of the discharging water through this spillway is directed away from the embankment. It appears that high discharges might overtop this guide dike and cause a small sheet flow over the embankment. It appears that the amount of flow would be small and would not endanger the safety of the dam.

D. Reservoir Area

This dam is located in the headwaters of the stream. The banks of the reservoir are flat and stable. Most of the drainage area is pasture land.

E. Downstream Channel

The area immediately downstream of the outlet pipe is flat and consists of a shallow, grassed streambed. Several homes are located within 2,000 feet downstream of the dam within the possible flood plain area. There is a potential for loss of life due to flood waters downstream from the dam if the dam would fail. The hazard classification is therefore considered to be "High."

3.2 EVALUATION

The overall visual evaluation of the facilities indicates that the dam is in good condition. The emergency spillway has a good grass mat for protection against erosion. There was no evidence of stability or seepage problems on the downstream slope. To prevent damage to the protective vegetative cover of the embankment, it is recommended to discontinue the use of the embankment as a pasture for cattle.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

This dam is a flood control dam, maintained by Wayne County. All inflow is discharged through the uncontrolled principal spillway until the pool level reaches the elevation of the emergency spillway. The dam and facilities are regularly inspected by the County for possible maintenance requirements.

4.2 MAINTENANCE OF DAM

The embankment has been used as a pasture for cattle, causing considerable disturbance of the vegetative cover of the downstream slope. Weed growth on the slopes could become a problem if not kept under control.

4.3 MAINTENANCE OF OPERATING FACILITIES

The only operating facility is an underwater drawdown pipe. This pipe is closed off with a slide gate. It was not operated during the inspection. The drop inlet structure is accessible by boat only.

4.4 WARNING SYSTEM

There is no formally organized surveillance or downstream warning system in operation for this dam.

4.5 EVALUATION

Although the operational procedures for this dam are minimal, the facilities are in good condition. A formal surveillance plan and downstream warning system should be developed for implementation during periods of heavy or prolonged precipitation. Grazing of cattle should be discouraged.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analyses available from PennDER and SCS for SCS Dam PA-419 are extensive. A spillway rating curve, area-capacity curve, stage storage curve, stage area curve, design flood hydrograph and flood routing are all contained in the PennDER files. The computations contained in Appendix D of this report were made as a check on the designer's computations. The designer's computations are in reasonably close agreement with those in the appendix.

The design flood hydrograph used by the designer was based on an SCS 6 hr. point rainfall hydrograph, having 8.73 inches of runoff and producing a peak inflow of 1155 cfs. When routed through the reservoir, this flood caused the pond water level to rise to about 3.3 feet above the emergency spillway crest, leaving a freeboard of 2.5 feet.

Since the design flood was not the Probable Maximum Flood (PMF), computations are shown in Appendix D to evaluate the routing of a PMF through the project.

B. Experience Data

No records are maintained at SCS Dam PA-419; however, a local resident recalled that the maximum flood at this dam caused the water level to rise to about one foot below the emergency spillway crest. This storm was passed without difficulty.

C. Visual Observations

On the date of the inspection no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event, until the dam is overtopped.

D. Overtopping Potential

SCS Dam PA-419 has a total storage capacity of 139 acre-feet and the overall height is 29 feet above the streambed. These dimensions indicate a size classification of "Small." The hazard classification for this dam is "High" (See Section 3.1.E).

The recommended Spillway Design Flood (SDF) for a dam having the above classifications is in the range of one-half the PMF to the

full PMF. Since this dam is a flood control structure, the recommended SDF is the PMF. For this dam the PMF peak inflow is 1439 cfs (See Appendix D for hydraulic calculations).

Comparison of the estimated PMF peak inflow of 1439 cfs with the estimated total discharge capacity of 1580 cfs indicates that a potential for overtopping of the SCS Dam PA-419 by the PMF does not exist.

An estimate of the storage effect of the reservoir and routing of the computed inflow hydrograph through the reservoir shows that this dam has the necessary storage available to pass the PMF without overtopping. The spillway-reservoir system can pass a flood event equal to 100% of a PMF with about 0.4 foot of freeboard.

E. Spillway Adequacy

The small size and high hazard categories, in accordance with the Corps of Engineers criteria and guidelines, indicates that the Spillway Design Flood (SDF) for this dam is in the range of one-half the PMF to the full PMF. Since this dam is a flood control structure, the recommended SDF is the PMF.

Calculations show that the spillway discharge capacity and reservoir storage capacity combine to handle 100% of the PMF with about 0.4 foot of freeboard (Refer to Appendix D).

Since the spillway discharge and reservoir storage capacity can pass the full PMF without overtopping, the spillway is considered to be adequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

The visual inspection of SCS Dam PA-419 did not detect any signs of embankment instability. The field survey indicates that the embankment slopes are in accordance with the design slopes. The slopes are considered to be adequate for the height of dam under consideration.

2. Appurtenant Structures

The emergency spillway in the right abutment appeared to be in good condition with a good grassmat for erosion protection. The side slopes are stable and the flow of water is directed away from the toe of dam by a spur dike (Appendix A, Plate A-I).

B. Design and Construction Data

The information contained in the Design Report and the construction drawings indicate that this dam was designed using current and acceptable engineering procedures. Although stability calculations for the embankment were not located, the slopes are considered adequate for a 29 foot high flood control dam constructed as a homogeneous earthfill structure. A drain is shown on the plans (Plate V, Appendix E) about 27 feet downstream of the centerline dam. This drain consists of a 6-inch perforated pipe in a filter and outlets in the plunge pool.

The emergency spillway has a good protective grass mat and stable side slopes. The construction plans show a 6-inch drain pipe in a filter bed along the right side of the channel. This drain will intercept the sidehill drainage of the cut. The 24-inch outlet pipe cantilevers out beyond the toe of the embankment (Photograph No. 5, Plate C-III). The end of this pipe is supported on a concrete pier (Plate VI, Appendix E). The same drawing indicates also that 4 anti-seepage collars have been placed around the outlet pipe in the embankment.

C. Operating Records

Operating records for this dam have not been maintained.

D. Post Construction Changes

There have been no changes or modifications made to the dam since its completion in 1960.

E. Seismic Stability

This dam is located in Seismic Zone 1 and it is considered that the static stability is sufficient to withstand minor earthquake-induced dynamic forces. No studies or calculations have been made to confirm this assumption.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection, the review of the design report, construction drawings and specifications indicate that SCS Dam PA-419 is in good condition and has been designed in accordance with current engineering practices. The field inspection did not detect any signs of instability or seepage that could be considered to endanger the safety of the dam.

The hydrologic and hydraulic computations indicate that the combination of storage capacity and the discharge of both spillways are adequate to handle 100 percent of the PMF. The spillway is considered to be adequate.

B. Adequacy of Information

The design information contained in the files is considered adequate for making a reasonable assessment of this dam. The conclusions reached, that this dam is adequately designed and constructed, is supported by the visual appearance of the entire facility.

C. Urgency

The recommendations presented below should be implemented as soon as possible.

D. Additional Studies

Additional studies are not required at this time.

7.2 RECOMMENDATIONS

In order to assure the continued satisfactory operation of this dam, the following recommendations are presented for implementation by the owner:

1. That the grazing of cattle on the embankment be discontinued.
2. That weed growth on the slopes will be controlled.
3. That a formal surveillance and downstream warning system be developed for implementation during periods of high or prolonged rainfall.
4. That a program be developed for regular inspection and maintenance of the dam and its appurtenant structures.

APPENDIX A
CHECKLIST OF VISUAL INSPECTION REPORT

APPENDIX A

CHECK LIST

PHASE I - VISUAL INSPECTION REPORT

PA DER # 64-170

NDI NO. PA-00086

NAME OF DAM SCS PA-419 HAZARD CATEGORY High

TYPE OF DAM Earthfill

LOCATION Berlin TOWNSHIP Wayne COUNTY, PENNSYLVANIA

INSPECTION DATE 11/7/79 WEATHER Cloudy, Damp TEMPERATURE 40's

INSPECTORS: R. Houseal (Recorder) OWNER'S REPRESENTATIVE(s):

H. Jongsma

Mr. Martin (Property Owner)

R. Shireman

A. Bartlett

NORMAL POOL ELEVATION: 1259.0 (orifice) AT TIME OF INSPECTION:

BREAST ELEVATION: 1279.0

POOL ELEVATION: 1259+

SPILLWAY ELEVATION: 1274.0 (emergency)

TAILWATER ELEVATION: _____

MAXIMUM RECORDED POOL ELEVATION: 1273.0± (1977)

GENERAL COMMENTS: The general appearance of this dam is good. The inlet control is located in the reservoir upstream from the upstream toe of the embankment. This structure is accessible only by boat at normal pool elevation.

One wet area was observed downstream from the downstream toe of the embankment on the right side. The area is above pool level; hence, this drainage is attributed to the side hill drainage rather than seepage through the embankment.

VISUAL INSPECTION
EMBANKMENT

	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	None evident.
B. UNUSUAL MOVEMENT BEYOND TOE	None evident.
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	Upstream slope good condition. Downstream slope shows evidence of some surface disturbance due to cows grazing on the slope and their hoofs slipping and displacing the top cover.
D. ALIGNMENT OF CREST: HORIZONTAL: VERTICAL:	Horizontal alignment is good. See Survey profile for vertical alignment (Plate A-II).
E. RIPRAP FAILURES	Riprap is about 6 feet above normal pool elevation. Good condition.
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Embankment abuts natural ground on left side-good. Right side ends at emergency spillway - no abutment.
G. SEEPAGE	None observed through or under the embankment. Side hill drainage was noted. See sketch (Plate A-I).
H. DRAINS	None evident.
J. GAGES & RECORDER	Staff gage painted on concrete drop inlet spillway.
K. COVER (GROWTH)	Top of dam - short grass & cow manure. Slopes - grass and some weeds. Barren areas caused by cattle.

VISUAL INSPECTION
OUTLET WORKS
PRINCIPAL SPILLWAY

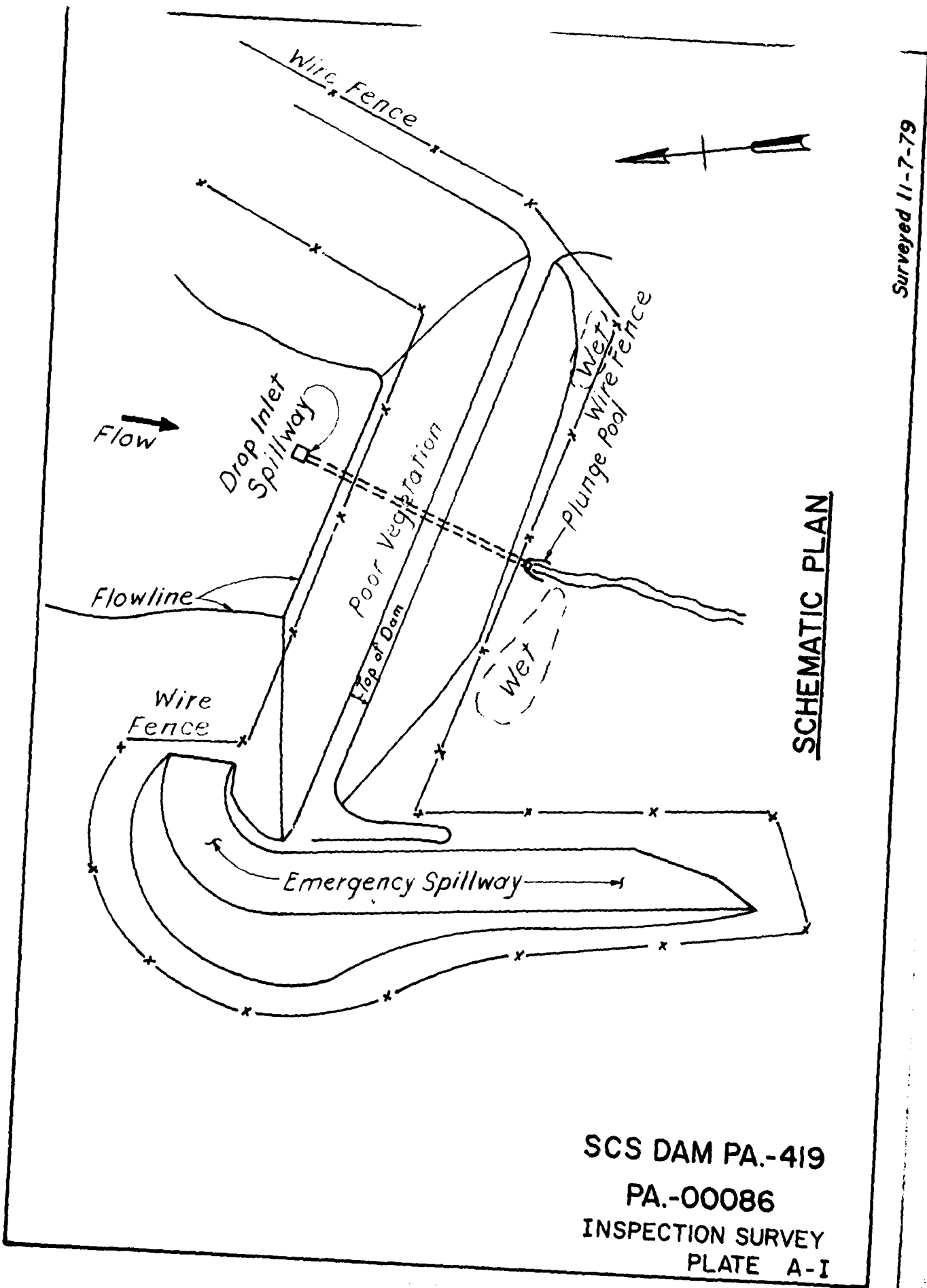
	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	Concrete drop inlet spillway - typical SCS design. Good condition. Accessible by boat only.
B. OUTLET STRUCTURE	24" diameter concrete pipe. No structure. Pipe emerges from embankment with riprap on each side into small plunge pool.
C. OUTLET CHANNEL	Natural field channel - narrow with grass slopes and stone bottom.
D. GATES	Gate located on intake structure - could not inspect. Control is from top of structure.
E. EMERGENCY GATE	Same as above.
F. OPERATION & CONTROL	Mr. Martin stated that maximum pool level was 1 ft. below emergency spillway.
G. BRIDGE (ACCESS)	None.

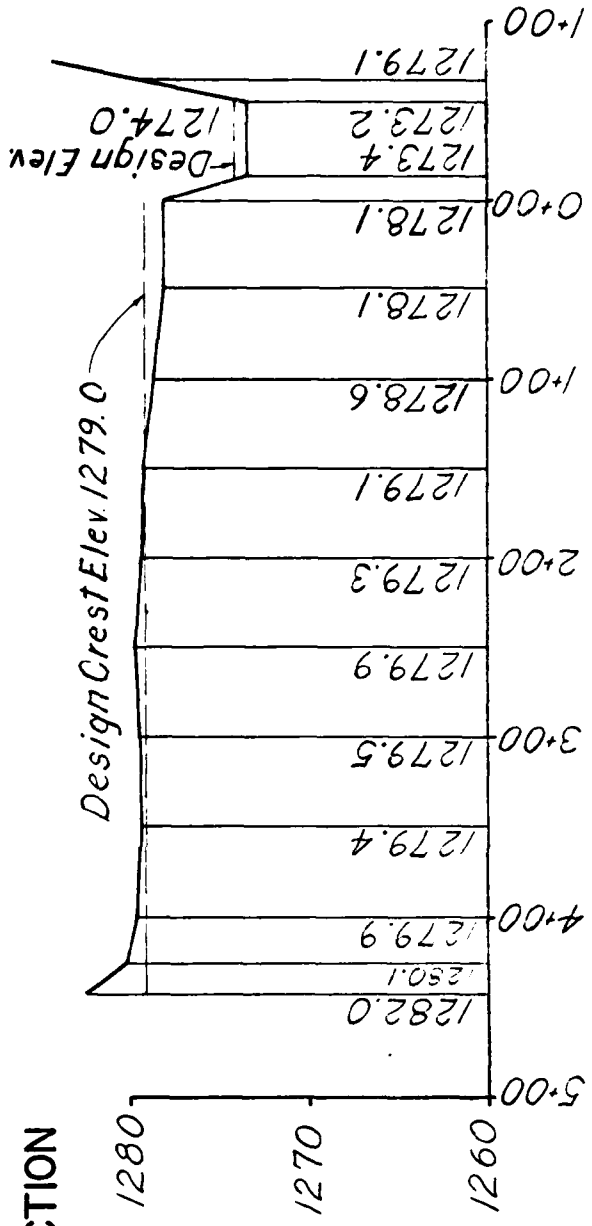
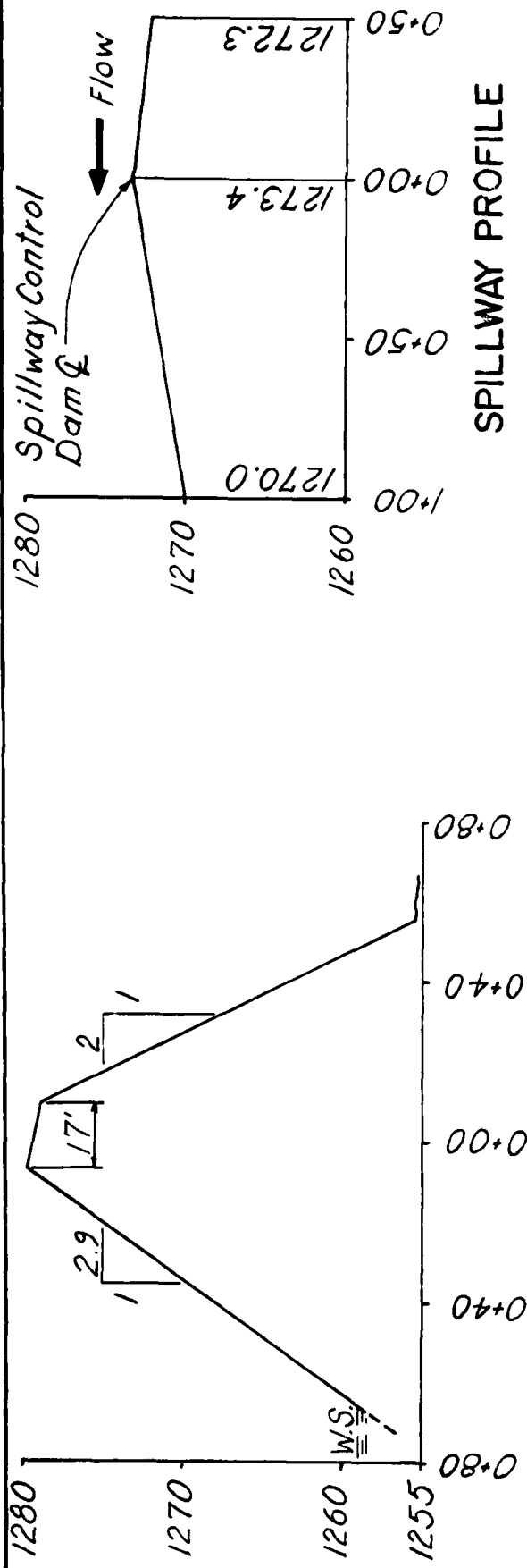
VISUAL INSPECTION
SPILLWAY
EMERGENCY SPILLWAY

	OBSERVATIONS AND REMARKS
A. APPROACH CHANNEL	Approach to emergency spillway directly from reservoir.
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Grassed emergency spillway is located at the right side of the embankment - good condition. Small natural spur dike on upstream side. Low embankment guide wall downstream.
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	Emergency spillway. Partial sheet flow close to embankment. Most flow away from dam.
D. BRIDGE & PIERS	None.
E. GATES & OPERATION EQUIPMENT	None.
F. CONTROL & HISTORY	None.

VISUAL INSPECTION

	OBSERVATIONS AND REMARKS
<u>INSTRUMENTATION</u>	
Monumentation	None.
Observation Wells	None.
Weirs	None.
Piezometers	None.
Staff Gauge	Painted on drop inlet structure (2 ft. above pool)
Other	None.
<u>RESERVOIR</u>	
Slopes	10°-15° - cultivated and moderate woodland.
Sedimentation	None reported.
Watershed Description	Pasture land.
<u>DOWNSTREAM CHANNEL</u>	
Condition	Narrow and overgrown with grass and brush. Meadow or field stream - typical.
Slopes	Channel slopes moderate to nearly flat in the flood plain.
Approximate Population	10
No. Homes	One immediately downstream. Two more further down.





Surveyed 11-7-79

SCS DAM PA.-419
 PA.-00086
 INSPECTION SURVEY
 PLATE A-II

APPENDIX B
CHECKLIST OF ENGINEERING DATA

APPENDIX B

CHECK LIST
ENGINEERING DATA

PA DER # 64-170

NDI NO. PA-00 086

NAME OF DAM SCS DAM PA-419

ITEM	REMARKS
AS-BUILT DRAWINGS	In files of SCS.
CONSTRUCTION DRAWINGS	In PennDER files.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle White Mill, Pa. See Plate II, Appendix E
CONSTRUCTION HISTORY	Construction started in 1959 and completed in 1960.
GENERAL PLAN OF DAM	Plate III, Appendix E.
TYPICAL SECTIONS OF DAM	Plate V, Appendix E.
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	See Appendix E. In PennDER files.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	None.
DESIGN REPORTS	In PennDER files.
GEOLOGY REPORTS	In Design Report
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	In Design Report. None. None.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	In Design Report. Yes. Yes.
POST CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Excavation for emergency spillway and possible on the sides of the pool.

ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	Property owner reported a maximum pool level one foot below the emergency spillway in 1977. No official records.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	None.
MAINTENANCE & OPERATION RECORDS	Copies of annual maintenance inspection by the County.
SPILLWAY PLAN, SECTIONS AND DETAILS	See Appendix E.

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	One 12-inch slide gate for drawdown.
CONSTRUCTION RECORDS	None.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	Inspection reports by the County. No deficiencies except mowing and other minor items.
MISCELLANEOUS	

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 85% farmland, 15% woodland

ELEVATION:

TOP NORMAL POOL & STORAGE CAPACITY: Elev. 1259 Acre-Feet 12TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev. 1278.1 Acre-Feet 139MAXIMUM DESIGN POOL: Elev. 1279TOP DAM: Elev. 1278.1

SPILLWAY:	SEDIMENT POOL	PRINCIPAL	EMERGENCY
a. Elevation	<u>1259</u>	<u>1261.67</u>	<u>1273.2</u>
b. Type	<u>orifice</u>	<u>rectangular orifices</u>	<u>broad crested weir</u>
c. Width	<u>12" dia.</u>	<u>each 6' x 8"</u>	<u>41'</u>
d. Length	<u>upstream toe</u>	<u>upstream toe,</u>	<u>left</u>
e. Location Spillover	<u>center of dam</u>	<u>center of dam in</u>	<u>abutment</u>
	<u>in drop inlet structure</u>	<u>drop inlet structure</u>	
f. Number and Type of Gates	<u>none</u>	<u>none</u>	<u>none</u>

OUTLET WORKS:

a. Type 12" slide gate

b. Location upstream toe, center of dam in drop inlet structure

c. Entrance inverts 1249.75

d. Exit inverts 1248

e. Emergency drawdown facilities slide gate

HYDROMETEOROLOGICAL GAGES:

a. Type none

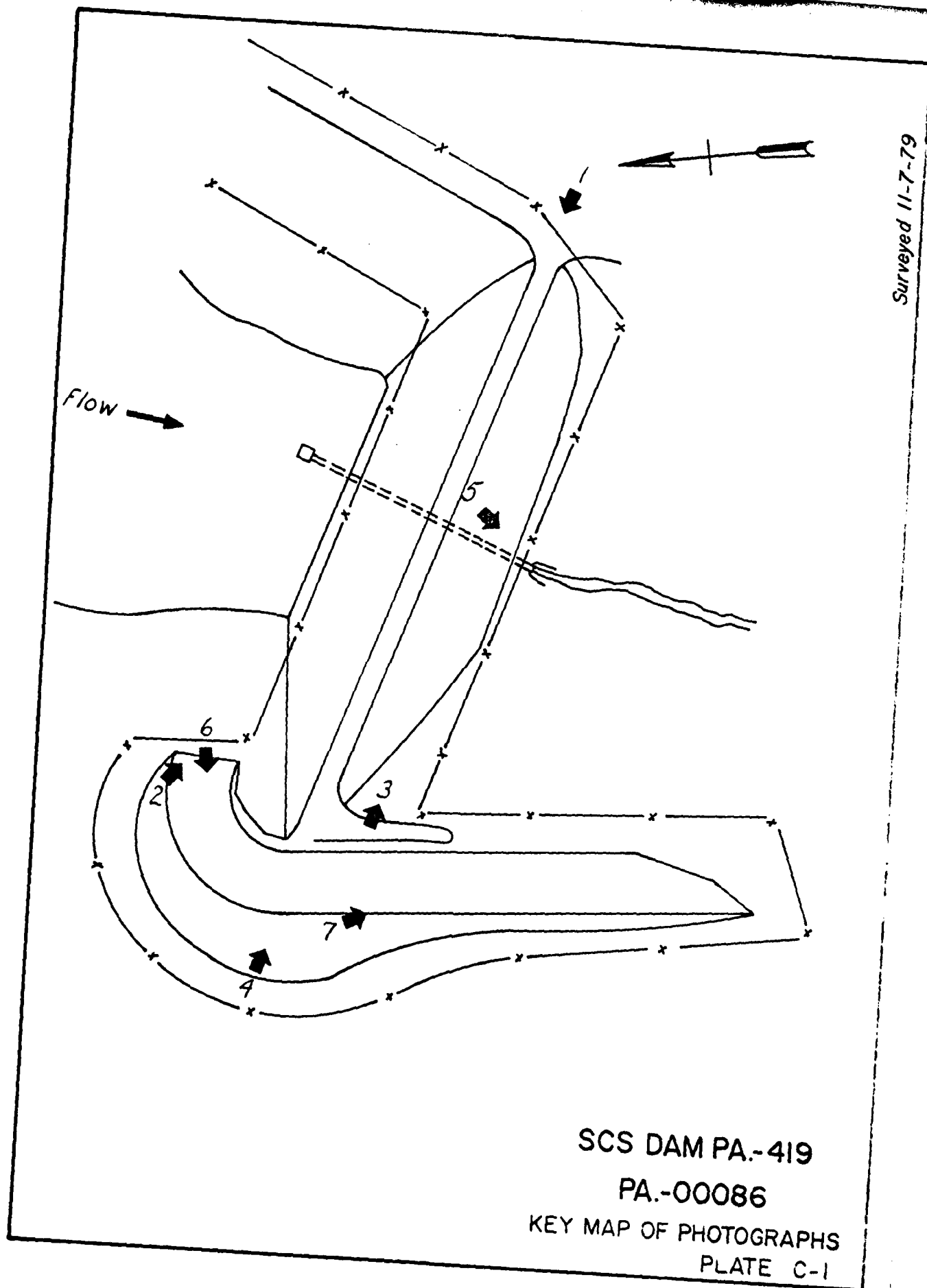
b. Location _____

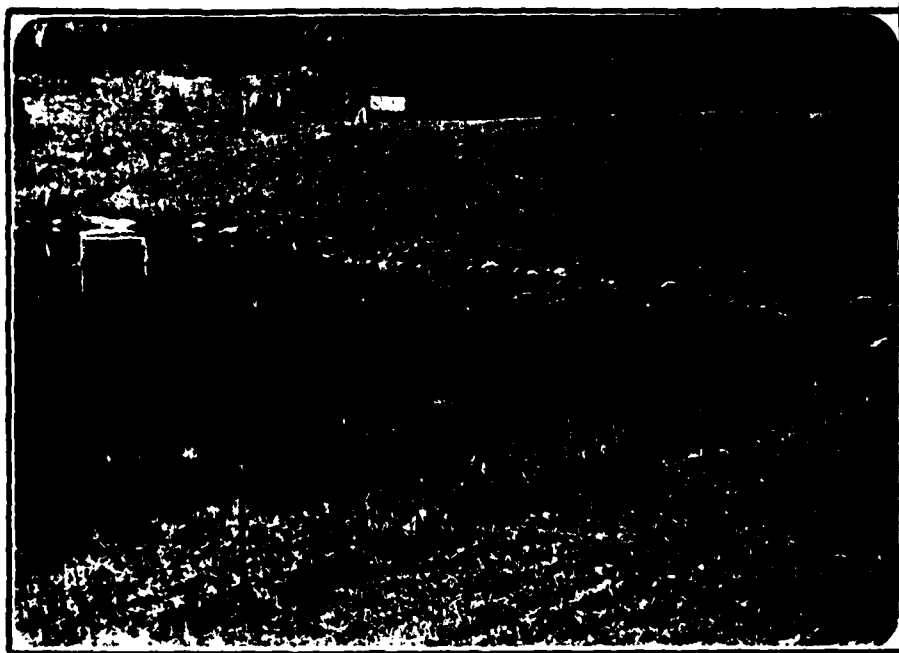
c. Records _____

MAXIMUM NON-DAMAGING DISCHARGE: 1580 cfs

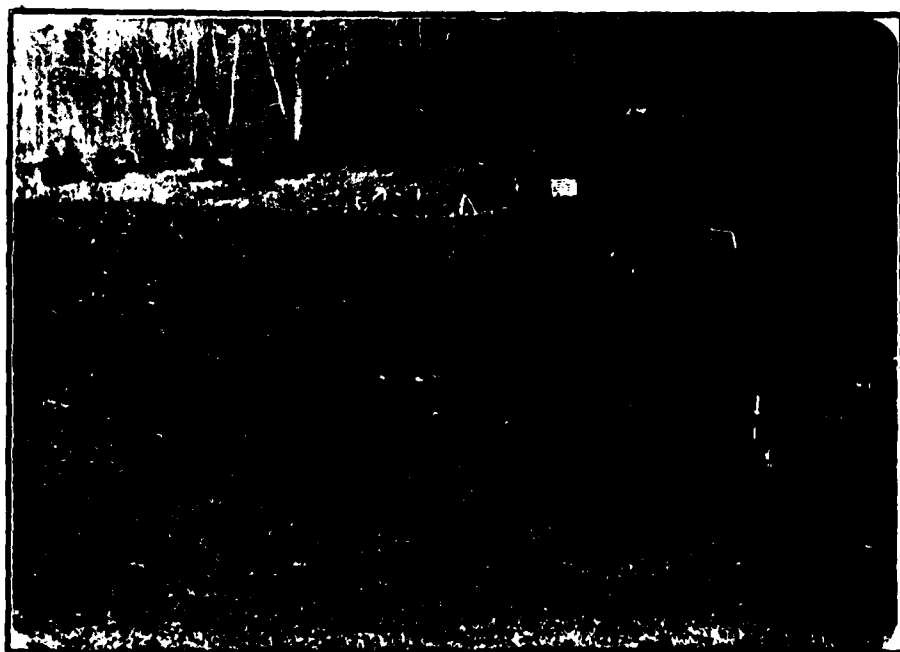
APPENDIX C
PHOTOGRAPHS

APPENDIX C





UPSTREAM SLOPE - NO. 2



DOWNSTREAM SLOPE - NO. 3

PA-00086
Plate C-II



OVERVIEW FROM RIGHT HILLSIDE
EMERGENCY SPILLWAY IN FOREGROUND - NO. 4



OUTLET PIPE & PLUNGE POOL - NO. 5

PA-00086
Plate C-III



EMERGENCY SPILLWAY LOOKING DOWNSTREAM - NO. 6



END OF EMERGENCY SPILLWAY - NO. 7
NOTE: FENCE ACROSS SPILLWAY

PA-00086
Plate C-IV

APPENDIX D
HYDROLOGY AND HYDRAULIC CALCULATIONS

APPENDIX D

SUMMARY DESCRIPTION
OF
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam, and (2) the capability to estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam overtopping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

The results of the studies conducted for this report are presented in Section 5.

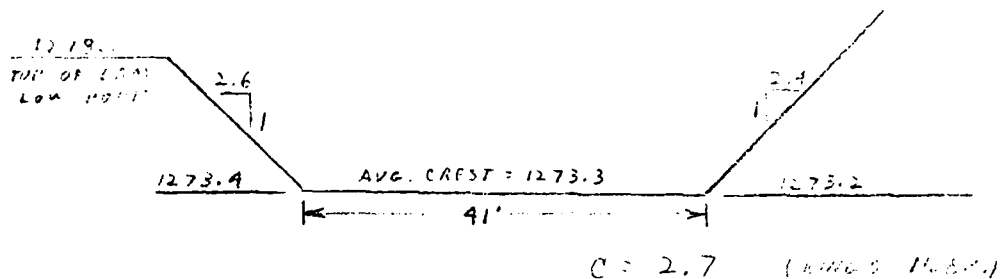
For detailed information regarding this program refer to the Users Manual for the Flood Hydrograph Package (HEC-1) Dam Safety Version prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

BY RLS DATE 2/5/80
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 1 OF 1
PROJECT 09650

EMERGENCY SPILLWAY RATING



$$Q = C L H^{3/2}$$

$$L = (41 + 41 + 2.4H + 2.6H) / 2$$

AT POOL ELEV. 1278.1

$$H = 1278.1 - 1273.3$$
$$= 4.8$$

$$L = (41 + 41 + 2.4(4.8) + 2.6(4.8)) / 2$$
$$= 53$$

$$Q = 2.7 \times 53 \times (4.8)^{1.5}$$

$$= 1505 \text{ CFS}$$

BY RLS DATE 2/5/80
 CHKD. BY _____ DATE _____
 SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 2 OF
 PROJECT 14655

PA: 919

PRINCIPAL SPILLWAY RATING

$Q \text{ OR FICE} = \text{SEDIMENT POOL SPILLWAY DISCHARGE} = CA\sqrt{2gH}$, $C = 0.6$

$Q \text{ P.S.} = \text{PRINCIPAL SPILLWAY DISCHARGE} = CA\sqrt{2gH}$, $C = 0.6$

$\text{TOTAL } Q = Q \text{ OR FICE} + Q \text{ P.S.}$

$\text{OUTLET } H = 1250.25 + \text{HEAD ON DISCHARGE PIPE FROM RISER} = (Q/CA)^2/2g$, $C = 0.6$

ASSUMED WHEN SPILLWAY ORIFICES ARE SUBMERGED

$\text{OUTLET } Q = \text{FLOW THRU DISCHARGE PIPE FROM RISER} = CA\sqrt{2gH}$

$\text{ASSUMED } Q \text{ P.S.} = \text{ASSUMED DISCHARGE THRU PRINCIPAL SPILLWAY ORIFICE}$

$\text{COMPUTED POOL ELEV.} = \text{OUTLET } H + ((\text{ASSUMED } Q \text{ P.S.})/CA)^2/2g$

$\text{TOTAL } Q = \text{ASSUMED } Q \text{ P.S.} + Q \text{ ORIFICE} = \text{OUTLET } Q$

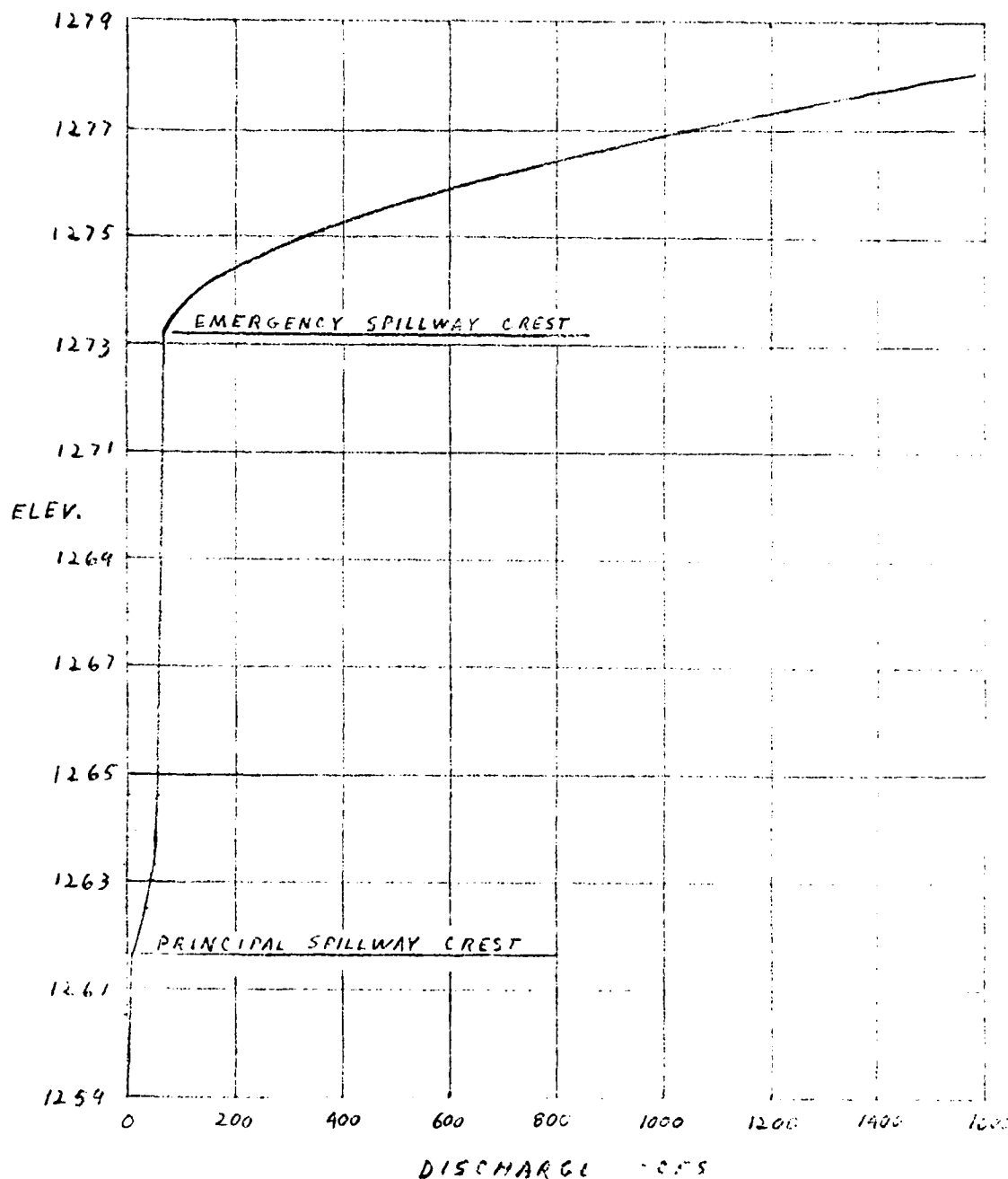
POOL ELEV.	Q ORIFICE	Q P.S.	TOTAL Q	OUTLET H	OUTLET Q	ASSUMED Q P.S.	COMPUTED POOL ELEV.	Q ORIFICE	TOTAL Q
1259	0	0	0						
1260.5	3.8	0	3.8						
1261.67	5.6	0	5.6						
1262.5	6.0	27.2	33.8	1255.25					
1263.0	7	39	46	1259	49	44	1263.3	5.7	49.7
				1261	52.5	47	1263.8	5	52
				1262.3	53.5	49	1264.6	5	54
				1263	60	55	1268	5	60
				1266	65.5	60	1271.4	6	66
				1269	68	62	1273.2	6	68
				1270.6	75	68	1279.1	7	75
				1275					

BY RLS DATE 2/6/80
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 3 OF
PROJECT D965

DISCHARGE RATING CURVE



BY RLS DATE 2/5/80
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 4 OF _____
PROJECT D 9658

DISCHARGE THRU POND DRAIN

12" DIA. ORIFICE $C = 0.6$
INVERT = 1249.75

AT NORMAL POOL LEVEL 1259
 $H = 1259 - 1250.25$
 $= 8.75$

$$Q = CA \sqrt{2gH}$$

$$= 0.6 \times \pi \times \left(\frac{11}{4}\right)^2 \times (2 \times 32.2 \times 8.75)^{0.5}$$

$$= 11 \text{ CFS}$$

AT LOW POOL ELEV. 1252
 $H = 1252 - 1250.25$
 $= 1.75$

$$Q = CA \sqrt{2gH}$$

$$= 0.6 \times \pi \times \left(\frac{11}{4}\right)^2 \times (2 \times 32.2 \times 1.75)^{0.5}$$

$$= 5 \text{ CFS}$$

BY RLS DATE 2/6/80
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 5 OF
PROJECT D 965

PA - 419

MAXIMUM KNOWN FLOOD AT DAM SITE

NO RECORDS ARE MAINTAINED AT SSS DAM PA-419, HOWEVER A LOCAL RESIDENT RECALLED THAT THE MAXIMUM FLOOD AT THIS DAM CAUSED THE WATER LEVEL TO RISE TO AN ELEVATION ABOUT ONE FOOT BELOW THE EMERGENCY SPILLWAY CREST. THE DISCHARGE AT THE TIME OF THAT FLOOD WAS 67 CFS (FROM RATING CURVE).

DESIGN FLOOD

SIZE CLASSIFICATION

MAXIMUM STORAGE = 139 ACFT-FOOT

MAXIMUM HEIGHT = 30 FEET

SIZE CLASSIFICATION IS "SMALL"

HAZARD CLASSIFICATION

SEVERAL HOMES ARE LOCATED NEAR THE CHANNEL ABOUT 2000 FEET DOWNSTREAM OF THE DAM.

USE "HIGH"

RECOMMENDED SPILLWAY DESIGN FLOOD

THE ABOVE CLASSIFICATIONS INDICATE USE OF AN SDF EQUAL TO ONE-HALF PART TO THE PROBABLE MAXIMUM FLOOD.

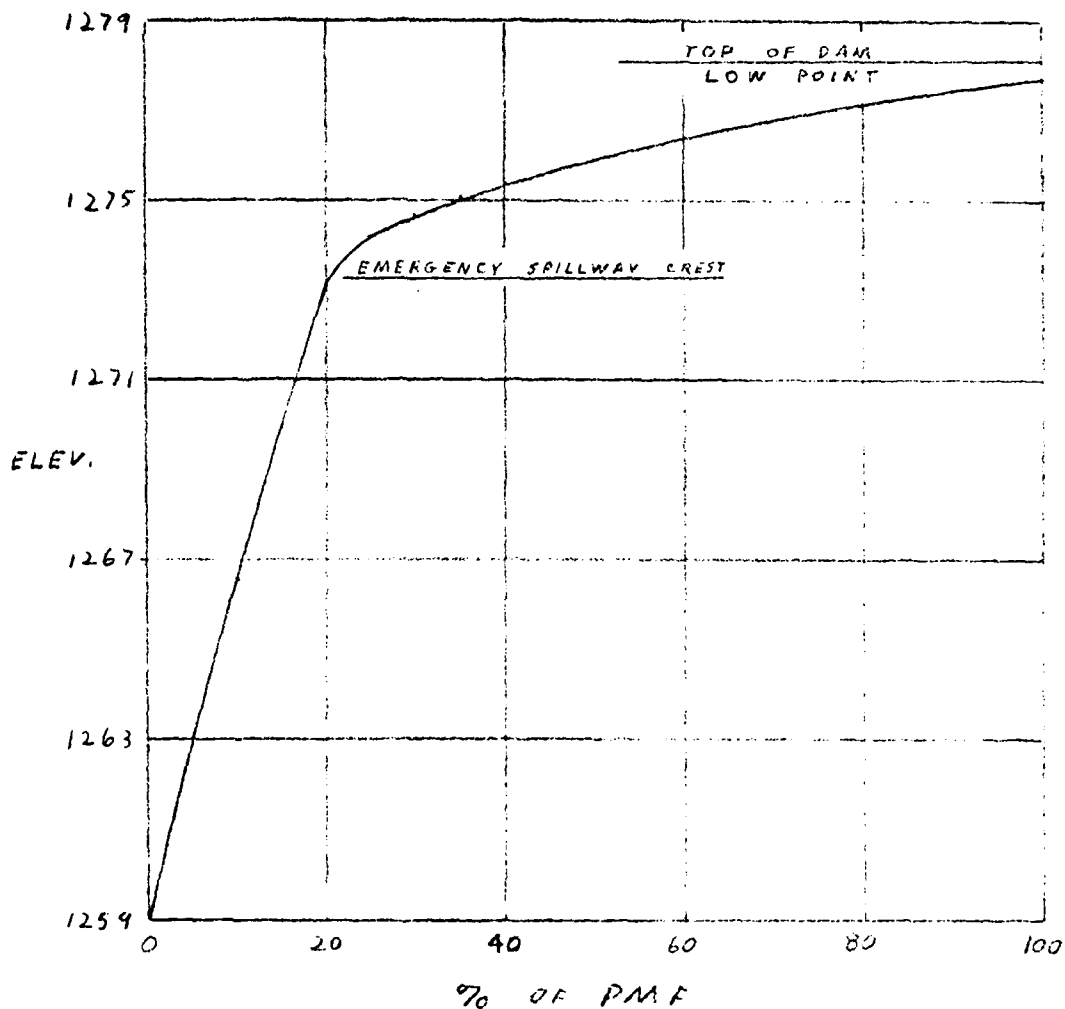
BY RLS DATE 2/6/80
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 6 OF
PROJECT D 9650

PA 414

DISCHARGE CAPACITY CURVE



HYDROLOGY AND HYDRAULIC ANALYSIS DATA BASE

NAME OF DAM: PA-419 RIVER BASIN: DELAWARE
PROBABLE MAXIMUM PRECIPITATION (PMP) = 21.3 INCHES/24 HOURS ⁽¹⁾

(FOR FOOTNOTES SEE NEXT PAGE)

STATION		1	2	3	4
STATION DESCRIPTION		Lake	Lake		
DRAINAGE AREA (SQUARE MILES)		.55			
CUMULATIVE DRAINAGE AREA (SQUARE MILE)		.55	.55		
ADJUSTMENT OF PMP FOR DRAINAGE AREA (%) ⁽²⁾	6 HOURS	111			
	12 HOURS	123			
	24 HOURS	133			
	48 HOURS	142			
	72 HOURS	--			
		Zone 1			
SNYDER HYDROGRAPH PARAMETERS	ZONE ⁽³⁾	1			
	C_p / C_t ⁽⁴⁾	.45/1.23			
	L (MILES) ⁽⁵⁾	1.34			
	L_{co} (MILES) ⁽⁵⁾	0.56			
	$T_p = C_t (L \cdot L_{co})^{0.3}$ (hours)	1.13			
SPILLWAY DATA	CREST LENGTH (FT.)		PRINCIPAL 12	EMERGENCY 41	ORIFICE Dia. = 1
	FREEBOARD (FT.)		16.4	4.8	19.1
	DISCHARGE COEFFICIENT		0.6	2.7	0.6
	EXPONENT		--	1.5	--
	ELEVATION		1261.67	1273.2	1259
AREA ⁽⁶⁾ (ACRES)	NORMAL POOL		2.1		
	ELEV. <u>1270</u>		7.2		
	ELEV. <u>1280</u>		12.1		
STORAGE (ACRE-Feet)	NORMAL POOL ⁽⁷⁾		12		
	ELEV. <u>1241.9</u> ⁽⁸⁾		0		
	ELEV. _____ ⁽⁸⁾				
	ELEV. _____ ⁽⁸⁾				

- (1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.
- (2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.
- (3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).
- (4) Snyder's Coefficients.
- (5) L = Length of longest water course from outlet to basin divide.
 L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.
- (6) Planimetered area encompassed by contour upstream of dam.
- (7) PennDER files.
- (8) Computed by conic method.

11/1
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

1	A1	SCS DAM PA-419	***	TRIBUTARY TO INDIAN ORCHARD BROOK						
2	A2	BERLIN TWP.								
3	A3	NDI # PA-00086		PA DER # 64-170						
4	B	300	0	15	0	0	0	0	0	-4
5	B1	5								
6	J	1	9	1						
7	J1	1	.9	.8	.7	.6	.5	.4	.25	.1
8	K		1					1		
9	K1		INFLOW HYDROGRAPH							
10	M	1	1	.55						
11	P		21.3	111	123	133	142			
12	T							1	.05	
13	W	1.13	.45							
14	X	-1.5	.05	2						
15	K	1	2					1		
16	K1		RESERVOIR ROUTING							
17	Y			1						
18	Y1	1						12	-1	
19	Y4	1259	1260.5	1261.67	1262.5	1263	1263.3	1263.8	1264.6	1265
20	Y41273.2		1274	1275.1	1276.1	1277	1278.1			
21	Y5	0	4	6	34	46	49	52	54	60
22	Y5	68	137	368	679	1039	1580			
23	Y6	0	2.1	3	4.9	7.2	9.9	12.1	13.7	16
24	Y61241.9		1259	1260	1265	1270	1275	1280	1285	1290
25	Y6	1259								
26	Y61278.1									
27	K	99								

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
END OF NETWORK	

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

RUN DATE# 80/02/06.
TIME# 06.11.42.

SCS DAM PA-419 *** TRIBUTARY TO INDIAN ORCHARD BROOK
BERLIN TWP., WAYNE COUNTY, PA.
NDI # PA-00086 PA DER # 64-170

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IFLT	IPRT	NOTAN
300	0	15	0	0	0	0	0	-4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

NO. 104 10-117 10-117 10-117 10-117 10-117 10-117 10-117 10-117 10-117 10-117
 BERLIN (U.F.) WAYNE (U.F.)
 HDI 4 FA-00086 10-117 10-117

2/4

SEP. 1961
 NO. 104 10-117 10-117 10-117 10-117 10-117 10-117 10-117 10-117 10-117 10-117
 HDI 4 FA-00086 10-117 10-117

MULTI-PLAN ANALYSES TO BE PERFORMED

NPLAN= 1 NRTID= 9 LRTID= 1
 RTICS= 1.00 .90 .80 .70 .60 .50 .40 .25 .10

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAG ICOMP IECON ITAPE JPLT JPRT INAME ISTATE IAUTH
 1 0 0 0 0 0 1 0 0

HYDROGRAPH DATA

IHYDS IURS TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL
 1 1 .55 0.00 .55 0.00 0.000 0 0 0

PRECIP DATA

SPFE PMS R6 R12 R24 R48 R72 R96
 0.00 21.30 111.00 123.00 133.00 142.00 0.00 0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT STARR DLTR RTIOL ERAIN STRKS RTIOK STRYL CNSTL ALGMA RTIMP
 0 0.00 0.00 1.00 0.00 0.00 1.00 1.00 .05 0.00 0.00

UNIT HYDROGRAPH DATA

TP= 1.13 CP= .45 NTA= 0

RECESSION DATA

STRTO= -1.50 GRCSN= .05 RTIGR= 2.00

UNIT HYDROGRAPH 41 END-OF-PERIOD ORDINATES, LAG= 1.12 HOURS, CP= .45 VOL= 1.00

13.	47.	52.	129.	140.	129.	115.	93.	55.	24.
65.	54.	49.	43.	37.	32.	28.	24.	21.	18.
16.	14.	12.	11.	9.	8.	7.	6.	5.	5.
4.	4.	3.	3.	2.	2.	2.	2.	1.	1.
1.									

0
 MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q

50.1 24.00 21.01 2.39 30811.
 (510.)(554.)(51.)(872.47)

RESERVOIR ROUTING

INSTN	ICDIF	RECDN	TIME	WAT	STRT	INLET	OUTLET	UNIT
2	1	0	0	0	0	1	0	0
RECDN 0.1111								
0.000	0.000	0.000	1	0	0	0	0	0
INSTN	ICDIF	RECDN	TIME	WAT	STRT	INLET	OUTLET	UNIT
1	0	0	0.000	0.000	0.000	12.	-1	

STAGE	1259.00	1260.50	1261.67	1262.50	1263.00	1263.30	1263.50	1264.00	1265.00	1271.40
	1273.20	1274.00	1275.10	1276.10	1277.00	1278.10				
FLOW	0.00	4.00	8.00	34.00	40.00	49.00	52.00	54.00	60.00	66.00
	68.00	137.00	370.00	679.00	1039.00	1620.00				
SURFACE AREA=	0.	2.	3.	5.	7.	10.	12.	14.	16.	
CAPACITY=	0.	12.	15.	34.	64.	107.	162.	238.	300.	
ELEVATION=	1242.	1259.	1260.	1265.	1270.	1275.	1280.	1285.	1290.	

ORCL	SPWID	CCS4	EXPD	ELEV	CCCL	CAREA	CAFL
1259.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RAIN DATA

TIME	CODE	EXP	PARWID
1275.1	0.0	0.0	0.

PEAK OUTFLOW IS 1385. AT TIME 41.00 HOURS

PEAK OUTFLOW IS 1244. AT TIME 41.00 HOURS

PEAK OUTFLOW IS 1098. AT TIME 41.25 HOURS

PEAK OUTFLOW IS 952. AT TIME 41.25 HOURS

PEAK OUTFLOW IS 797. AT TIME 41.25 HOURS

PEAK OUTFLOW IS 631. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 465. AT TIME 42.00 HOURS

PEAK OUTFLOW IS 176. AT TIME 43.25 HOURS

PEAK OUTFLOW IS 57. AT TIME 43.75 HOURS

4/4

PEAK FLOW AND STORAGE (END OF FLOOD) SUMMARY AND RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CFS) BEINGS PER SECOND
 AREA IN SQUARE KILOMETERS (KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				1.00	.90	.80	.70	.60	.50	.40	.25	.10
HYDROGRAPH AT	1	.55	1	1439.	1295.	1151.	1007.	863.	719.	575.	330.	144.
	(1.42)		(	40.74)(	36.66)(	32.59)(	28.52)(	24.44)(	20.37)(	16.29)(	10.18)(	4.07)
ROUTED TO	2	.55	1	1385.	1244.	1098.	952.	797.	631.	465.	176.	57.
	(1.42)		(	39.22)(	35.22)(	31.09)(	26.95)(	22.59)(	17.87)(	13.15)(	4.99)(	1.63)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

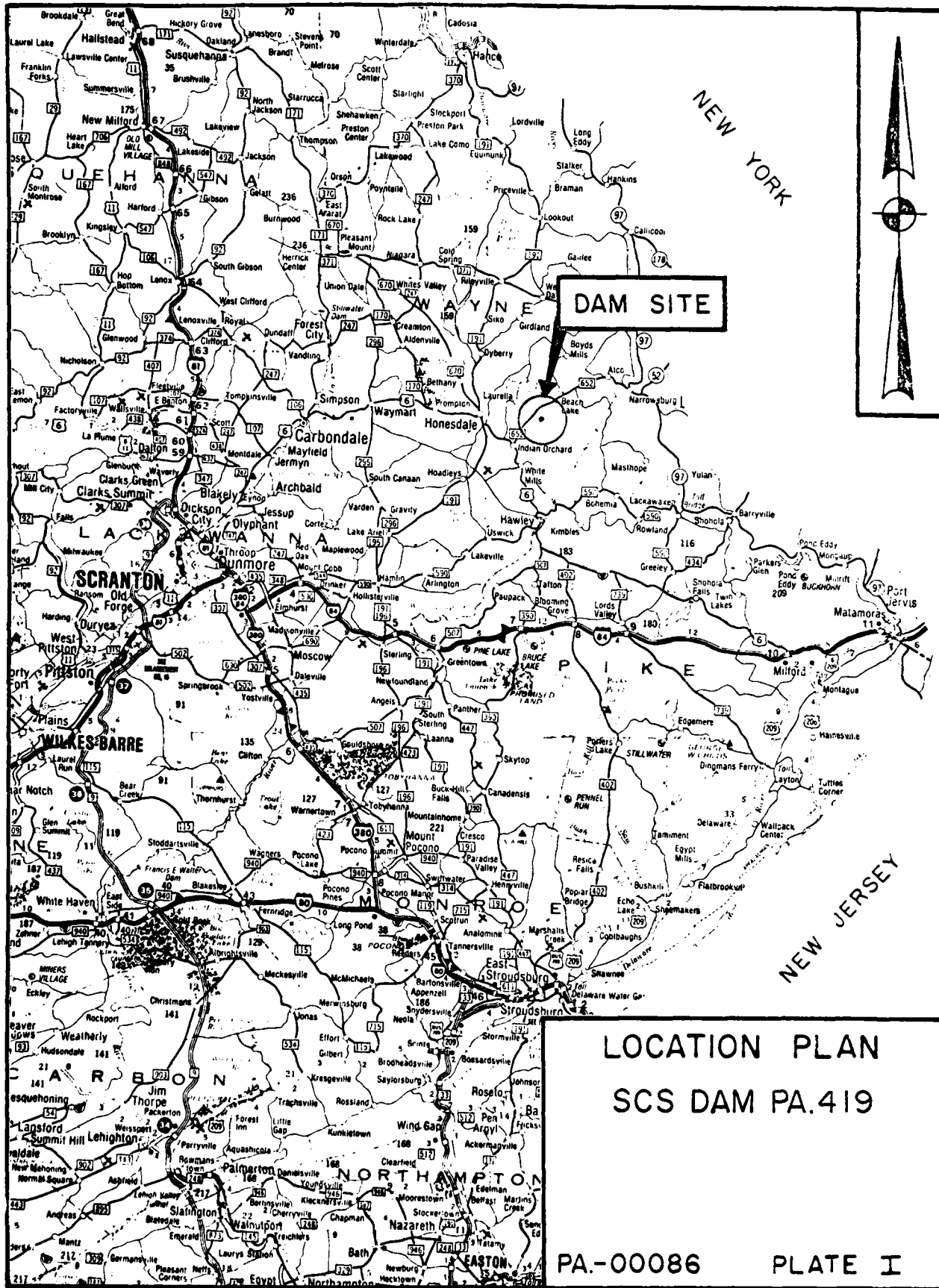
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1259.01	1259.00	1270.10
STORAGE	12.	12.	139.
OUTFLOW	0.	0.	1580.

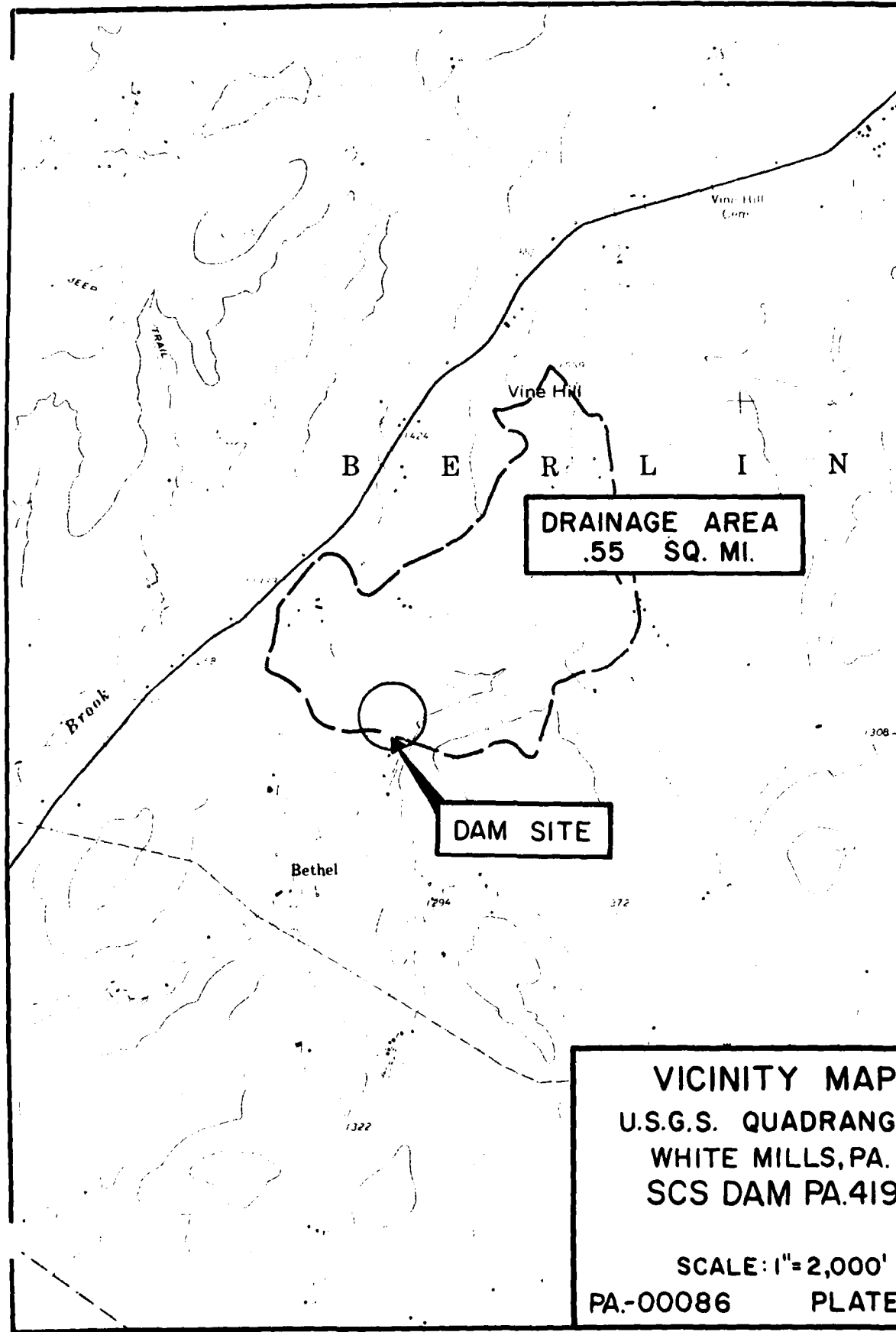
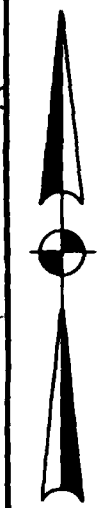
RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1277.70	0.00	135.	1385.	0.00	41.00	0.00
.90	1277.42	0.00	132.	1244.	0.00	41.00	0.00
.80	1277.12	0.00	129.	1098.	0.00	41.25	0.00
.70	1276.78	0.00	125.	952.	0.00	41.25	0.00
.60	1275.40	0.00	121.	797.	0.00	41.25	0.00
.50	1275.95	0.00	116.	631.	0.00	41.50	0.00
.40	1275.41	0.00	111.	465.	0.00	42.00	0.00
.25	1274.19	0.00	99.	176.	0.00	43.25	0.00
.10	1266.58	0.00	42.	57.	0.00	43.75	0.00

EOI ENCOUNTERED.

APPENDIX E

PLATES





B E R L I N

DRAINAGE AREA
.55 SQ. MI.

DAM SITE

Bethel

VICINITY MAP
U.S.G.S. QUADRANGLE
WHITE MILLS, PA.
SCS DAM PA.419

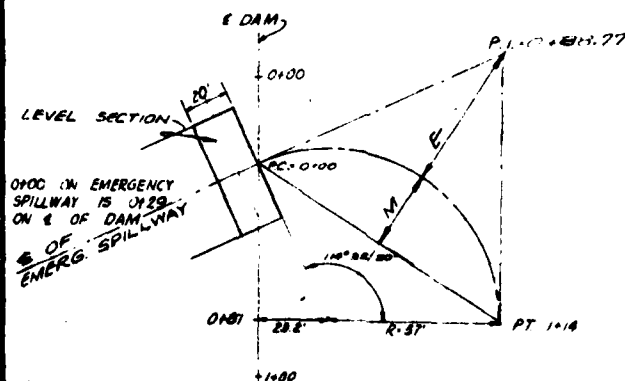
SCALE: 1"=2,000'
PA.-00086 PLATE II

6" SPILLWAY DRAIN
SEE SHEET 10 OF 10

CURVE #1

PT. = 1+14
PI. = 0+88.77
PC = 0+00
L = 114.0'
Δ = 114° 35' 30"
T = 88.77'
E = 48.51'
M = 26.21'
LC = 37.30'
R = 57'

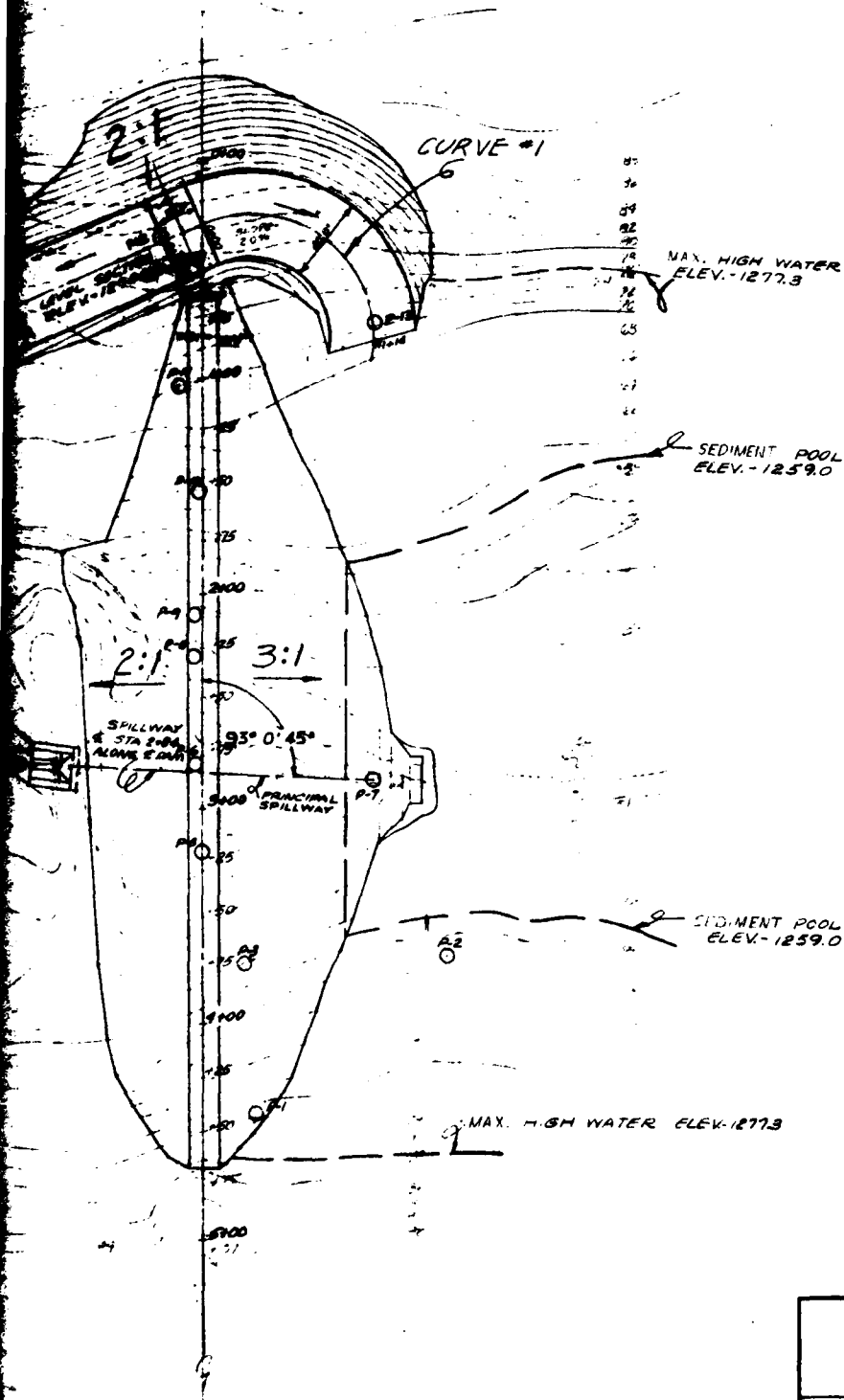
STATION	DEFLECTION	CHORD
0+00	0° 0' 0"	—
0+38	19° 05' 35"	37.30
0+76	38° 11' 50"	37.30
1+14	57° 17' 45"	37.30



LAYOUT OF EMERGENCY SPILLWAY CURVE
SCALE: 1"=30'

PLAN OF EMERGENCY SPILLWAY
29 ON 2 OF DAM

NOTE:
FOR DETAILS OF EMERGENCY SPILLWAY
CURVE SEE ELEV. IV



EARTH FILL SHALL BE COMPACTED
FILL, CLASS B-3 SPEC. PA-3-58

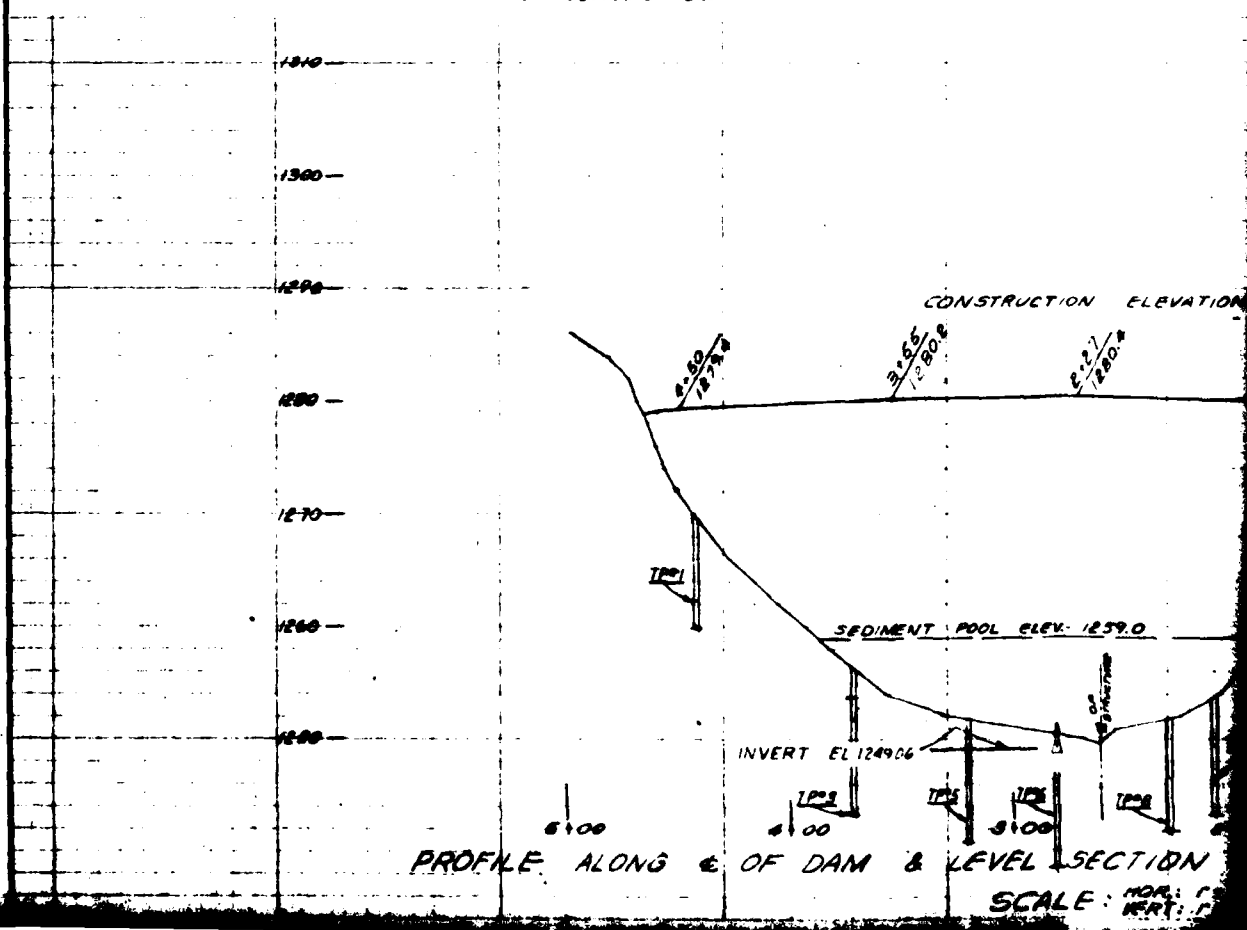
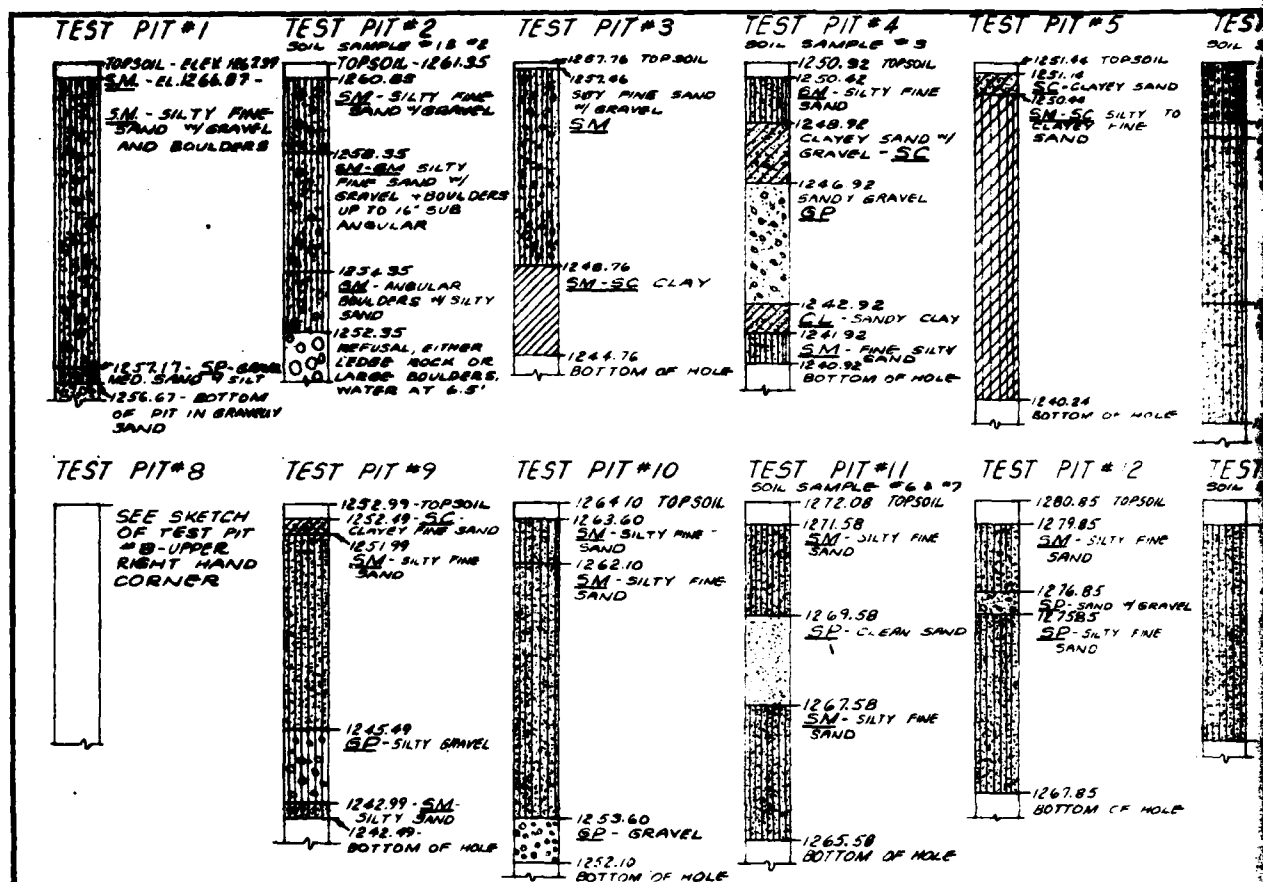
ALL EXCAVATION CONSIDERED
COMMON SPEC. PA-4-58

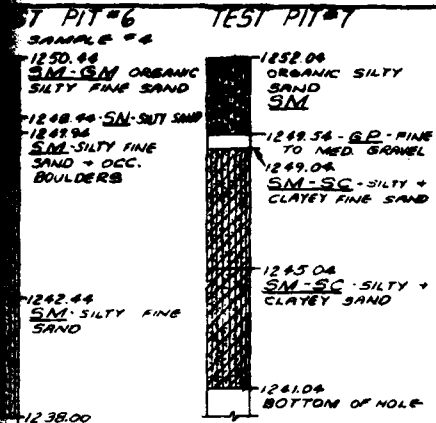
TOP OF DAM - ELEV. 1279.0

SCALE: 1" = 40'
O - OPEN TEST PIT

DAM SITE			
LACKAWAXEN TRIB. WATERSHED PROTECTION PROJECT SITE PA-419 WAYNE COUNTY, PA.			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed	C. RIGHT	7-58	Site
Drawn	J. WITYNSKI	9-58	Title
Checked	R. S. R.	7-58	Drawn by
Traced			Title
Reviewed			Drawn by

PA-0008
PLATE II

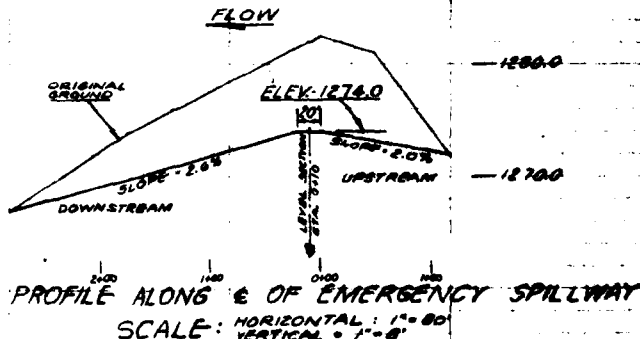
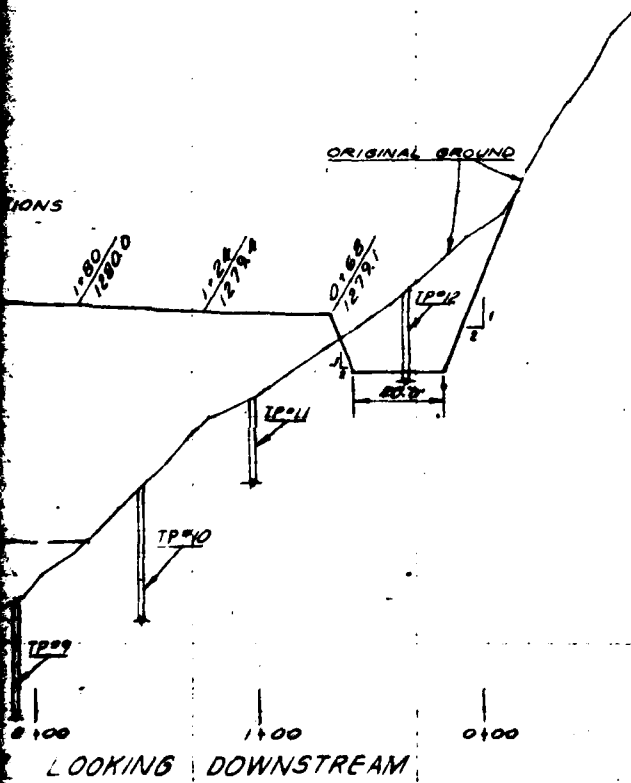
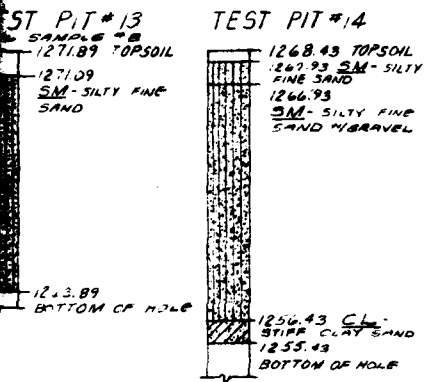
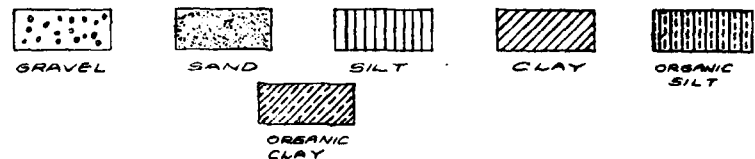




PIT CAVED IN AS UNDERCUT BY FLOWING GRAVEL

TEST PIT #8
 VIEW LOOKING DOWNSTREAM

LEGEND

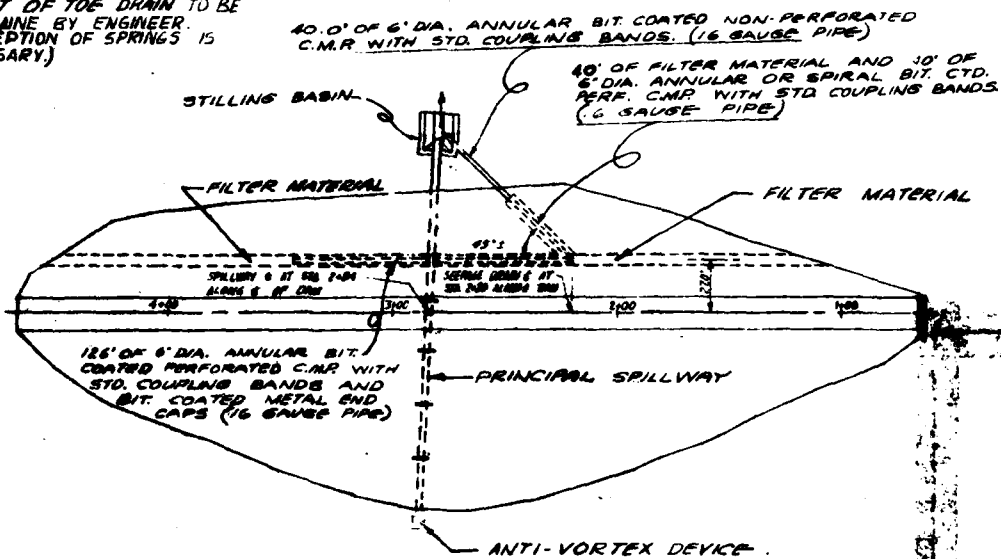


SOIL INFORMATION & PROFILE THRU EMERGENCY SPILLWAY LACKAWAXEN TRIB. WATERSHED PROTECTION PROJECT SITE PA-419 WAYNE COUNTY, PA.			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed C. RIGHT	7-58	Date	Approved By
J. WITYNSKI	W. CARROLL	9-58	Time
Drawn			
C. FORD		9-58	Time
Trace			
Checked			
			PA-419 B

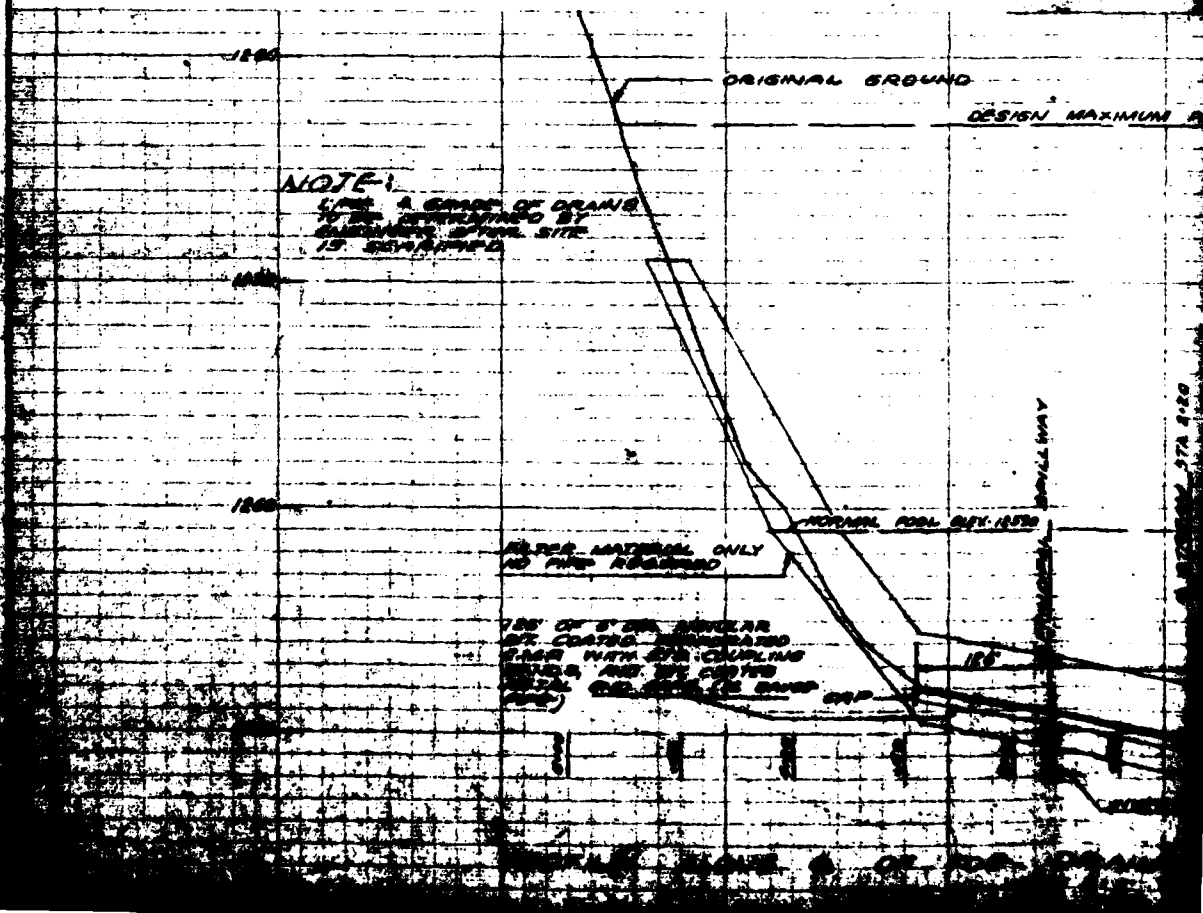
PA-00086
 PLATE II

NOTE:

LAYOUT OF TOE DRAIN TO BE
DETERMINE BY ENGINEER
(INTERCEPTION OF SPRINGS IS
NECESSARY.)

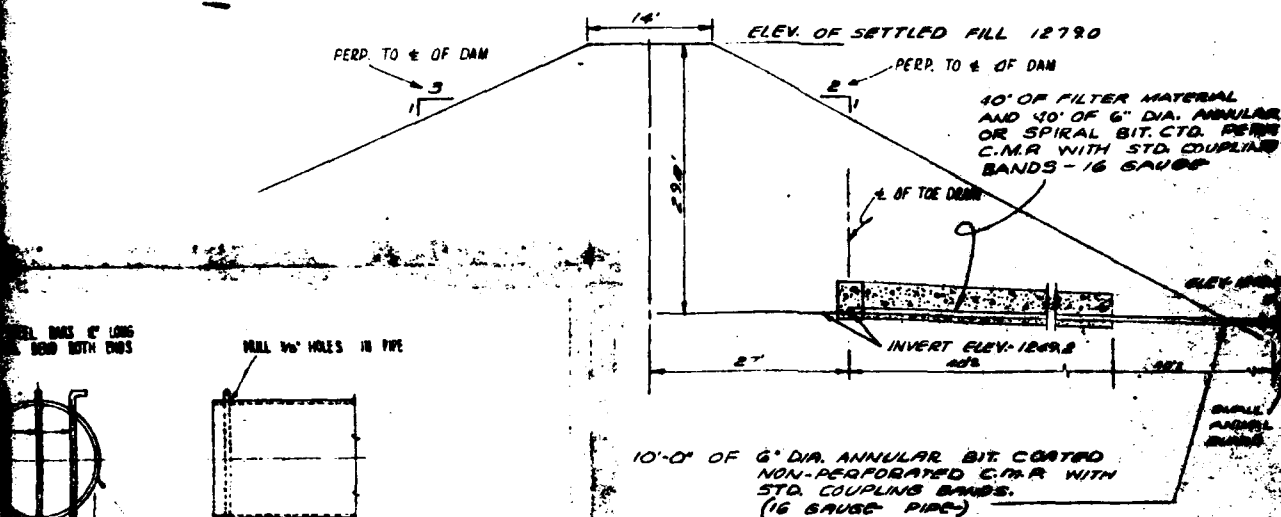


PLAN VIEW OF SEEPAGE & TOE DRAIN
SCALE: 1"=40'



NOTE:

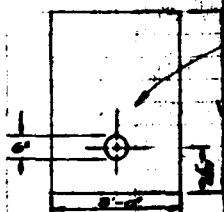
EXACT LOCATION OF TOE DRAIN
DETERMINED BY ENGINEER
IN THE FIELD.



SECTION ALONG \pm OF SEEPAGE DRAIN
NOT TO SCALE

NOTE:

WHERE ONLY FILTER MATERIAL IS USED
THIS SECTION IS THE SAME EXCEPT
THAT THE PIPE IS OMITTED



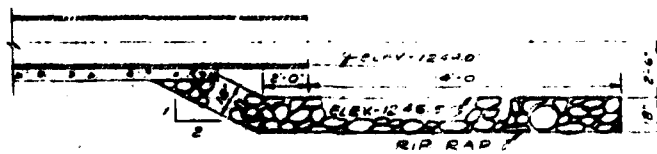
TYPICAL SECTION OF TOE DRAIN
SCALE: 1'-8'-0"

DETAILS OF DRAIN
LACKING THE
PROTECTION

U.S. BUREAU OF
RECONSTRUCTION

PA-0000
PLATE

REINFORCED CONCRETE
 2 ONCE FOR 100
 HEADS
 FLOOR ELEV. 154'-05.1'
 SEE DETAIL #1 FOR
 RISER & RISE
 CONNECTION SHEET
 1 OF 9
 RAMP
 STAIRS
 SEE SHEET 7
 7.67'



SECTION ON CENTERLINE

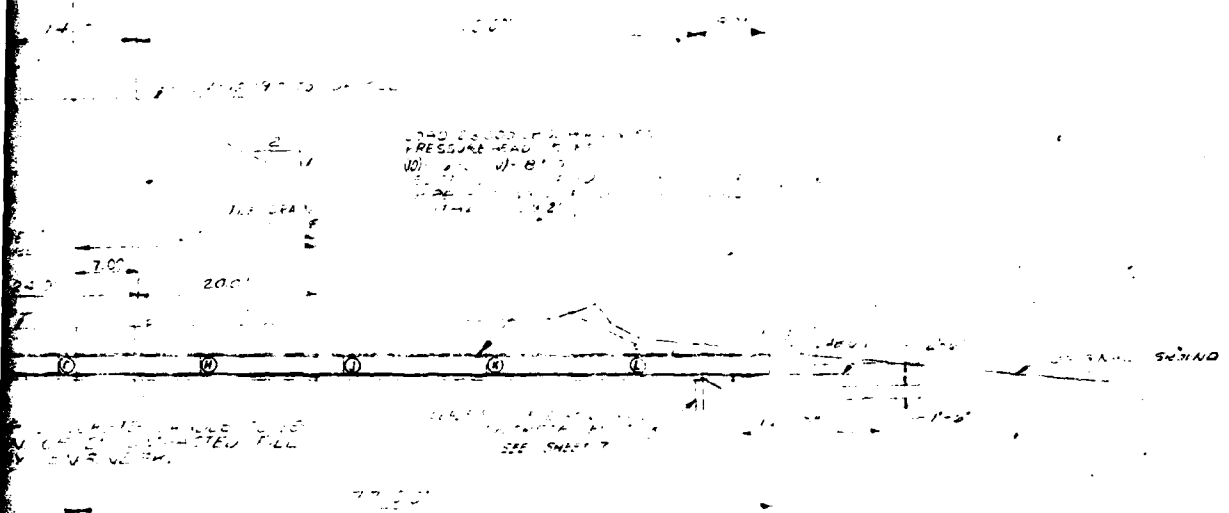
DETAIL OF PRINCIPAL SWILWAY STILLING BASIN

MANUFACTURERS

SLIDE HEAD

DET

NOTES



PH 4-1-4. 2/12/83

	1244.00	1244.00
A	1244.00	1244.00
C	1244.00	1244.00
E	1244.00	1244.00
F	1244.00	1244.00
G	1244.00	1244.00
H	1244.00	1244.00
I	1244.00	1244.00
J	1244.00	1244.00
K	1244.00	1244.00
L	1244.00	1244.00
M	1244.00	1244.00
N	1244.00	1244.00
O	1244.00	1244.00
P	1244.00	1244.00

STH OF PLE
NOTED
A

HEADGATE FRONT ELEVATION
(RING ONLY) SECTION THRU HEADWALL

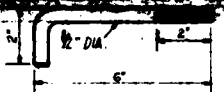
DETAIL OF HEADGATE AND HEADWALL (1-REQ)

PROFILE THRU PRINCIPAL SPILLWAY
LACKAWAXEN TRIB. WATERSHED
PROTECTION PROJECT EWE PA-10
WAYNE COUNTY, PA.

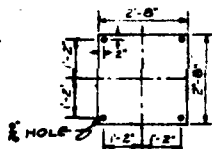
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed by J. WITTHORN, E. CARROLL, E. J.	Checked by
Project C. B. FORD	10-516
Profile	

PA-0000
PLATE 2

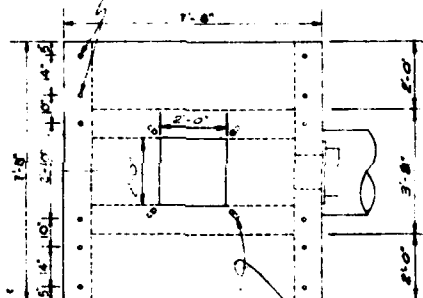


ANCHOR BOLT
(4 REG WITH NUTS & WASHERS)



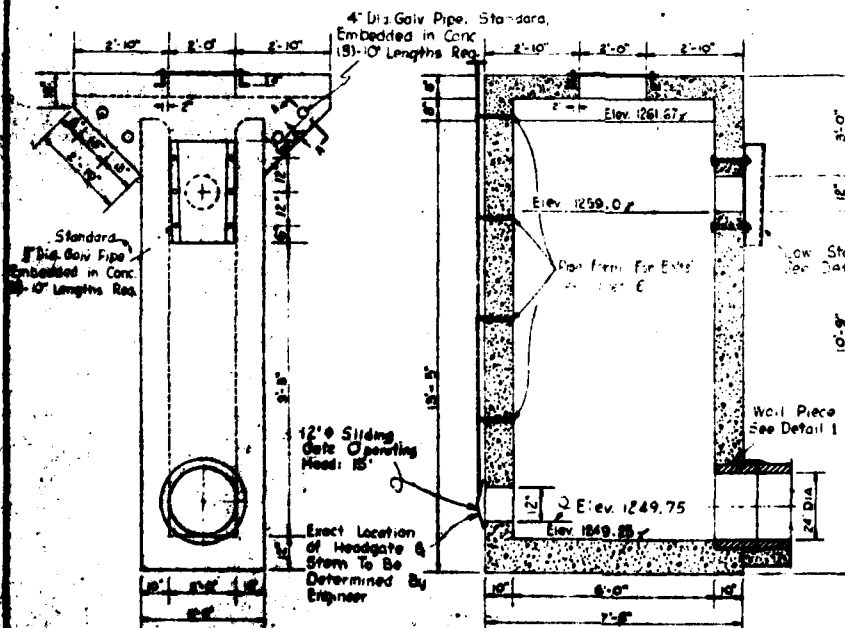
STEEL COVER PLATE
(1/2" THICK)

IF PRE-CAST SLABS ARE USED
(12) #4'S STEEL BARS WILL BE
EMBEDDED AT THESE LOCATIONS
IN THE RISER 15' LONG



TOP VIEW

12 #4 Anchor Bolts
Embedded in Conc
(4' Reg)



REAR ELEVATION

SECTION ON CENTERLINE

REINFORCED CONCRETE RISER

NOT TO SCALE

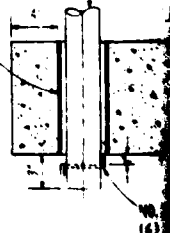
NOTE
FOR STEEL DETAILS SEE SHEETS 5 & 9

FOR DETAILS OF HEADGATE
SEE SHEET 6

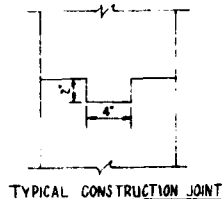
FOR DETAILS OF PRE-CAST SLABS
SEE SHEET 7

4" DIA GALV PIPE
STD. STRENGTH
(14) 10' LENGTHS REQ

1" DIA GALV
STD. STRENGTH
(4) 8' LENGTHS REQ



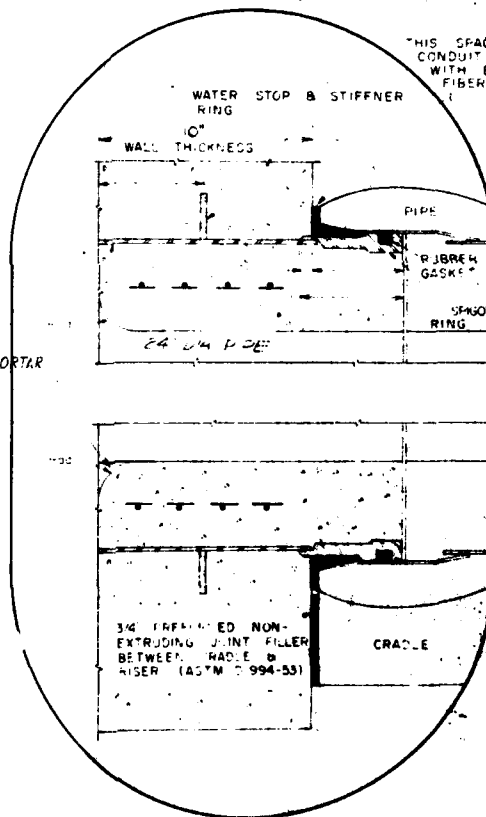
SECTION AA
SCALE 1/2" = 1'



BILL OF MATERIALS

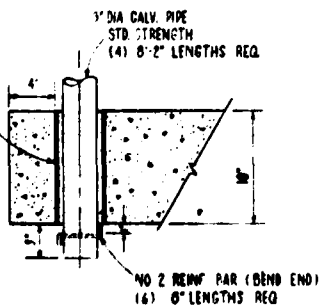
ITEM	SIZE	LENGTH	NUMBER REQUIRED
TRASH GUARD			
SHEET METAL	36"x39"		1
BOLT	1" DIA.	13"	6
GALV. PIPE	1/2" DIA.	10"	6
MANHOLE			
ANCHOR BOLT	1/2" DIA.	8"	4
STEEL COVER PLATE	32"x32"		1
TRASH RACK			
GALV. PIPE STD. STR.	1/2" DIA.	8'-2"	4
GALV. PIPE	1/2" DIA.	10"	8

FILL WITH MORTAR
ALONG FLOOR
& SIDEWALL



THIS SPACE AROUND
CONDUIT TO BE PACKED
WITH BITUMINOUS
FIBERGLASS CEMENT

DL OF WALL PIECE IN RISER
NOT TO SCALE



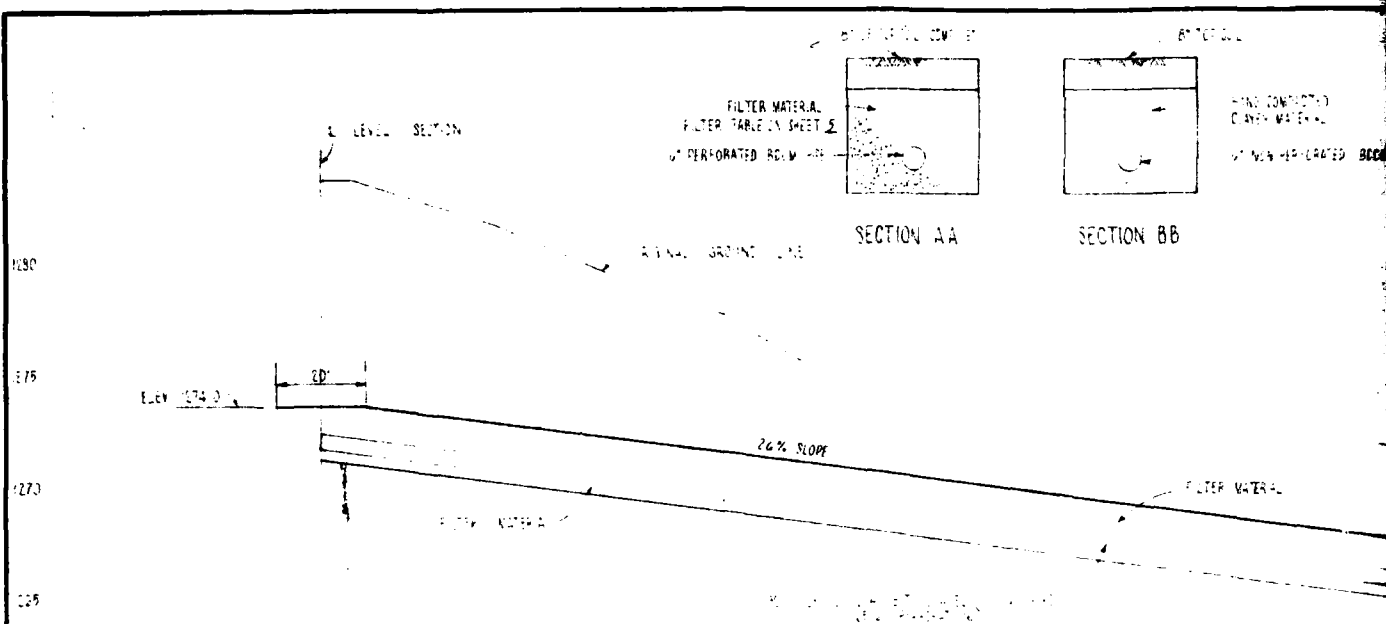
STRUCTURAL DIMENSIONS

LACKAWANNA TRIB. WATERWAYS
PROTECTION PROJECT SITE PL-33
WAYNE CO. PENNA.

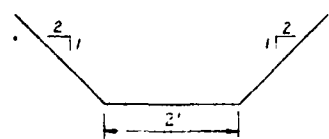
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

Designed by J. WITVINSKI	Date 10-55	Drawn by A. GERMANA	Date 10-55
Checked by		Reviewed by	

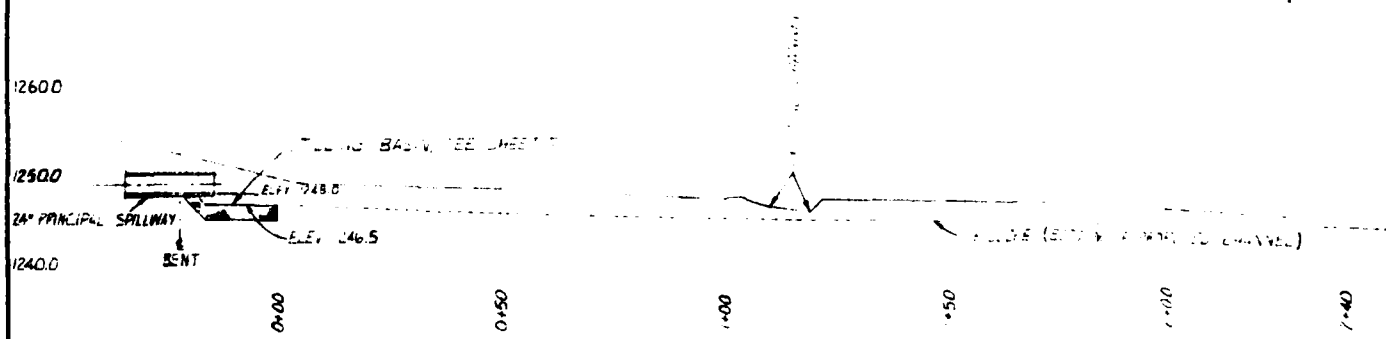
PA-00086
PLATE VII



NOTE: THE FOLLOWING IS A SUMMARY OF THE DATA FOR THE PROJECT.



TYPICAL SECTION OF OUTLET CHANNEL
NOT TO SCALE

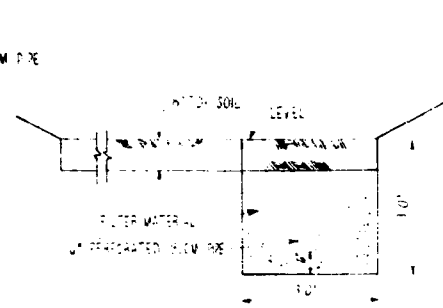


LONGITUDINAL SECTION OF OUTLET CHANNEL
SCALE: 1" = 100'

TOP SOIL

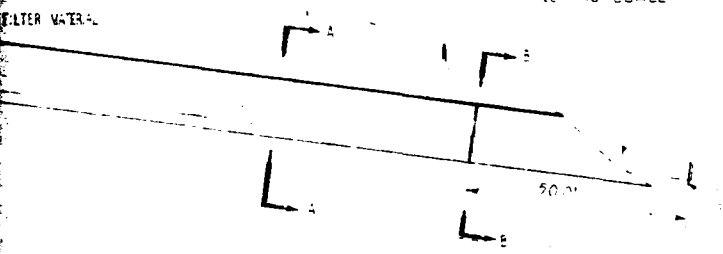
4" AND COMPOSTED
COUNTRY MATERIAL

1/2" NON-REINFORCED BECM PIPE



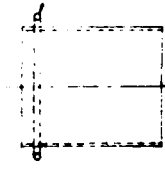
NOTE: FILTER TO BE IN ACCORDANCE WITH FILTER TABLE ON SHEET 2

TYPICAL SECTION OF EMERGENCY SPILLWAY DRAIN
NOT TO SCALE

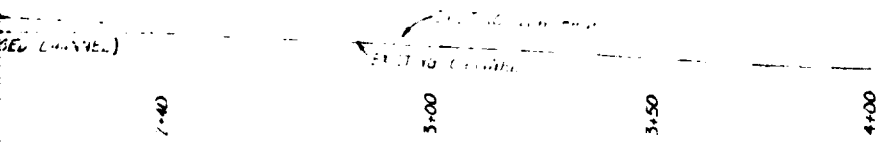


1" STEEL BARS 2' LONG
RED BEND BOTH ENDS

DRILL 1/2" HOLES IN PE



DETAIL OF SMALL ANIMAL GUARD - NOT TO SCALE
(1 REQ)



OF OUTLET CHANNEL
Z = 20.0'
X = 10.0'

DETAILS OF SPILLWAY DRAIN & OUTLET CHANNEL			
LACAWAXEN TRIB WATERSHED PROTECTION PROJECT SITE PA-419 WAYNE CO. PA			
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Drawn by C. M. FIGHT	Date 8-58	Approved by Title	Sheet No. 10
Check by H. MORGAN	Date 11-58	Title	
Drawn by S. GERMANA	Date 11-58	Title	

PA-00086
PLATE VII

APPENDIX F
GEOLOGIC REPORT

APPENDIX F

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Name: Catskill Formation, undifferentiated.

Lithology: Primarily grayish red siltstone with some fine grained silty sandstone interbeds.

Structure

The site is within the Pocono Plateau area and the beds are essentially horizontal.

Air photo fracture traces trend: N5° to 10°E, N30°E and N85°W.

Overburden

This site is within the limits of Pleistocene glaciation, and a variable thickness of glacial till and outwash sediments. Of nine backhoe pits dug in the vicinity of the embankment, only one, hit bedrock at nine feet. The geologists report for the dam site reports that the pits ranged from 7.5 to 13 feet deep. An average log is given as follows:

0 - 0.5'	Topsoil.
0.5 - 1.0	Red clayey sand.
1.0 - 7.5	Silty fine sand, brown to tan, occasional gravel.
7.5 - 10.0	Silty gravel, three inch to twelve inch cobbles and boulders; wet, flowing water.
10.0 - 10.5	Silty sand.

The material appears to be primarily, outwash and alluvium, with some till also probably present.

Aquifer Characteristics

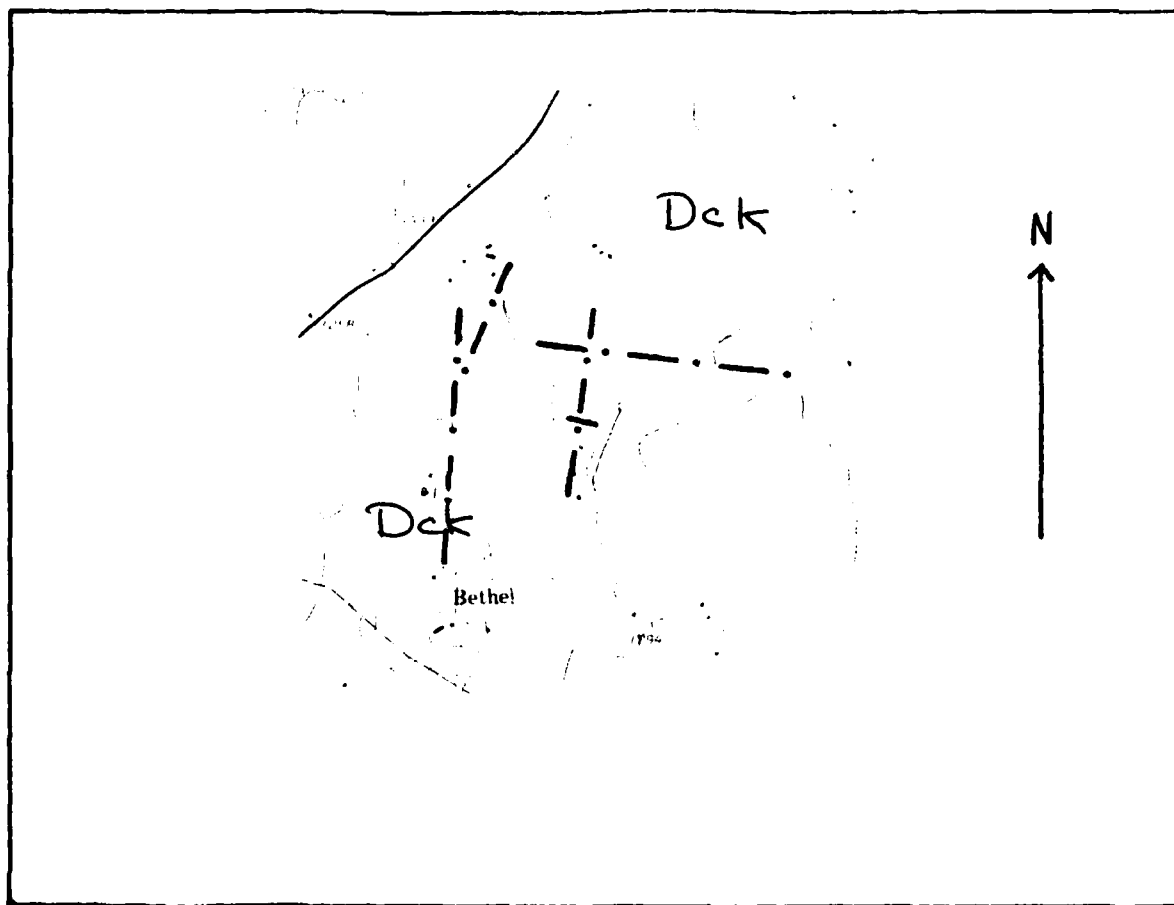
The rocks of the Catskill Formation are essentially impermeable. Ground water movement is entirely along bedding planes and fractures. The most permeable aquifers in the area are in the glacial outwash materials in the valleys. It is notable, however, that a number of springs shown on the topographic map and on the air photos are apparently related to fracture traces. This seems to indicate that flow through the bedrock fractures has an effect on flow in the surficial material.

Discussion

The logs of the test pits indicate that the outwash and alluvium in the center of the valley carry ground water. There is the potential for leakage along this zone. However, since this is a flood control dam that impounds only a sediment pool under normal conditions, and is full only during flood conditions, it is probable that such leakage would not cause damage to the structure.

Sources of Information

1. Manuscript Geologic Map of the White Mills Quadrangle, on open file, Pa. Geologic Survey, Harrisburg, Pa.
2. Geologic report by C. Newlin, dated June 26, 1958; in correspondence file.
3. Air photos, scale approx. 1:40,000. Dated 1973.

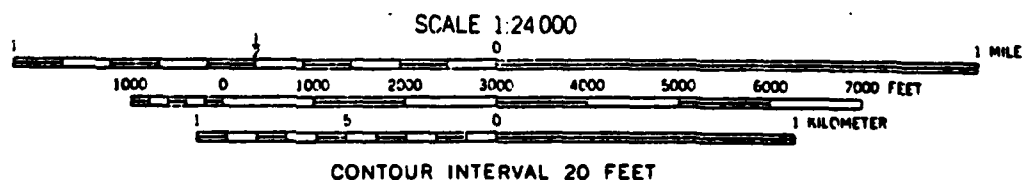


key

Dek

Catskill Fm. - undifferentiated

--- air photo fracture trace



CONTOUR INTERVAL 20 FEET